ANNUAL REGISTER

OF THE

UNITED STATES NAVAL ACADEMY,

ANNAPOLIS, MD.

TWENTY-NINTH ACADEMIC YEAR,

1878-79.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1878.

OFFICERS' DIRECTORY.

U. S. NAVAL ACADEMY,

ANNAPOLIS, MD., FEBRUARY 1, 187

Commodore FOXHALL A. PARKER, Superintendent.

Commander F. V, McNair.....No. **1**, Officers' Quarte
" Jno. A. Howell,..... " **6**, " "
" A. T. Mahan,..... " **9**, " "
" S. D. Greene,..... " **3**, " "
" M. Miller, ...U. S. Ship "Sante
" E. M. Shepard.....No. **4**, Officers' Quarte
Lieut. Comd'r A. D. Brown,.....No. **27**, Officers' Quarte
" C. V. Gridley,..... " **25**, " "
" W. M. Folger, ... " **20**, " "
" F. W. Dickins,..... " **17**, " "
" C. J. Train,..... " **18**, " "
Lieutenant S. Hubbard,.....No. **12**, *2nd Floor*, Officers' Quarte
" W. H. Brownson, ...Board House.
" M. R. S. Mackenzie,.....No. **86**, Prince George's St.,
" J. C. Soley,..... .....No. **15**, *2nd Floor*, Officers' Quarte
" S. W. Very,.....No. **9**, *2nd Floor*, Old Quarters, Cadet
" W. H. Parker,.. .....No. **12**, *4th Floor*, Officers' Quarte
" H. Knox,..... " **13**, *1st* " " "
" J. W. Miller,..... " **99**, King George's St.
" J. M. Miller,..... " **14**, *3rd Floor*. Officers' Quarters
" F. M. Wise,.....No. **14**, *1st Floor*, Officers' Quarte
" J. V. B. Bleecker, ... " **104**, King George's St.
" L. C. Logan,..... " **14**, *2nd Floor*, Officers' Quarte
" H. Perkins,..... " **9**, *1st Floor* Old Quarters, Cade
" R. R. Ingersoll,..... " **15**, *3rd Floor*, Officers' Quarte
" D. Kennedy,.....No. **15**, *4th Floor*, Officers' Quarte
" R. C. Derby,..... " **14**, *4th* " " "
" R. T. Jasper,..... " **12**, *3rd* " " "
" W. J. Barnette,.. .....**74½** Tabernacle St.
" G. W. Tyler,.....No. **27**, Officers' Quarters.
" A. B. Speyers,.....No. **8**, *2nd Floor*, Old Quarters, Cade
" C. G. Bowman,.....Maryland Hotel.
" S. C. Paine,.....No. **3**, Duke of Gloucester St.
" A. P. Nazro,.....No. **92**, Prince George's
" H. O. Rittenhouse,..... " **98**, King George's St.
Master G. L. Dyer,.....No. **77**, Prince George's St.,
" C. P. Rees,..... .....Board House.
" C. H. Lyman, ...Maryland Hotel.
" S. A. Staunton,.....No. **9**, *3d Floor*, Old Quarters, Cade
" A. Ward,.....Maryland Avenue and Hanover St.
" C. W. Bartlett,..... .....Board House.

Master W. P. Clason,.....No. **88**, Prince George's St.
" C. R. Miles,..... " **29½**, Hanover St.
Ensign A. A. Michelson,.....No. **27**, Corn Hill St.
" A. C. Hodgson,.....Board House.
Medical Inspector A. L. Gihon,.....No. **5**, Officers' Quarters.
P. A. Surgeon W. A. Corwin,.. .....No. **15**, 1*st Floor*, Officers' Quarters.
" " G. E. H. Harmon,.....Board House.
Acting Asst. Surgeon T. O. Walton,.....No. **11**, Maryland Avenue.
Paymaster A. S. Kenny, (*Commissary,*).....No. **2**, Officers' Quarters.
" F. H. Swan, (*Storekeeper,*)..... " **21**, " "
" W. N. Watmough, *Treasurer*,..... ..... " **22**, " "
Chief Engineer J. P. Sprague,..... ..... " **7**, " "
P. A. Engineer L. W. Robinson,.....No. **13**, 3*rd Floor*, Officers' Quarters.
" " C. H. Greenleaf,.....No. **8**, 3*rd Floor*, Old Quarters, Cadets.
" " D. Jones,.....No, **13**, 4*th Floor*, Officers' Quarters.
" " C. H. Manning,..... " **13**, 2*nd* " " "
" " G. H. Kearny,..... " **42**, Duke of Gloucester St.
Assistant Eng. A. V. Zane,.....No. **9**, 1*st Floor*, Old Quarters, Cadets.
Chaplain R. Hudson,.....No. **16**, Officers' Quarters.
Professor W. W. Hendrickson,..... " **10**, " "
" J. M. Rice,..... " **19**, " "
" J. R. Soley..... " **23**, " "
" H. D. Todd..... " **11**. " "
" L. F. Prud'homme,..... " **26**, " "
" M. Oliver,..... ..... " **8**, " "
" N. M. Terry,.....No. **1**, Duke of Gloucester St.
" C. E. Munroe,..... " **9**, 2*nd Floor*, Old Quarters, Cadets.
" P. Montaldo,..... " **9**, 1*st* " " " "
Ass't Professor, Thos. Karney,.....Maryland Avenue.
" " W. W. Fay,.....No. **102**, Prince George's St.
" " A. V. S. Courcelle, ...Lawyer St.
" " E. Dovilliers,.....No. **19**, Corn Hill St.
" " J. Leroux,.....Maryland Hotel.
" " H. Dalmon,.....No. **8**, 3*rd Floor*, Old Quarters, Cadets.
" " C. F. Blauvelt,..... " **9**, 3*d* " " " "
C. M. Chase, *Secretary*,.....No. **28**, Officers' Quarters.
W. J. Graff, *Ass't Librarian*,.....No. **8**, West St.
J. G. Glynn, 1*st Clerk*,.....No. **9**, Duke of Gloucester St.
W. H. Eldridge, 2*nd Clerk*..... ..No. **13**, Maryland Avenue.
J. M. McLeod, *Clerk to Comd't of Cadets*,.....No. **11**, Cathedral St.
Samuel Jickling, 3*rd Clerk*,..... Conduit St., extended.
T. E. Hawkins, *Boatswain*,.....U. S. Ship "Santee."
Robert Sommers, *Gunner*,.....Prince George's St.
L. J. Corbesier, *Sword Master*,.....No. **27**, Maryland Avenue.
J. B. Retz, *Ass't Sword Master*,.....Conduit St., extended,
Geo. Heintz, *Ass't Sword Master*,.....No. **7**, Market St.
Matthew Strohm, *Boxing Master*,.....No. **23**, Green St.

MARINE GARRISON.

Captain George P. Houston,.....Maryland Hotel.
1st Lieutenant, Geo. B. Haycock,..... ..... " "
" " Sam'l H. Gibson,.....No. **84**, Prince George's St.
2d " Sam'l J. Logan,..... " **29**, Hanover St.

CONTENTS.

THE

UNITED STATES NAVAL ACADEMY.

The United States Naval Academy was founded in 1845, by Hon. George Bancroft, Secretary of the Navy, in the administration of President James K. Polk. It was formally opened October 10, of that year, under the name of the Naval School, with Commander Franklin Buchanan as Superintendent. It was placed at Annapolis, Md., on the land occupied by Fort Severn, which was given up by the War Department for the purpose. The course was fixed at five years, of which the first and last only were spent at the School, the intervening three being passed at sea. This arrangement was not strictly adhered to, the exigencies of the service making it necessary, in many cases, to shorten the period of study. In January, 1846, four months after the opening of the School, the students consisted of 36 Midshipmen, of the date of 1840, who were preparing for the examination for promotion; 13 of the date of 1841, who were to remain until drafted for service at sea; and 7 Acting Midshipmen, appointed since September of the previous year. The Midshipmen of the date of 1840 were the first to graduate, finishing their limited course in July, 1846, and they were followed in order by the subsequent dates until the reorganization of the School, in 1851.

In September, 1849, a Board was appointed to revise the plan and regulations of the Naval School. The Board was composed of the following officers:

Commodore William B. Shubrick,
Commander Franklin Buchanan,
Commander Samuel F. DuPont,
Commander George P. Upshur,
Surgeon W. S. W. Ruschenberger,
Professor William Chauvenet,
Captain Henry Brewerton, U. S. A.

The plan reported by the Board was approved, and went into operation July 1, 1850.

The new organization provided for a course of seven years, the first two and last two at the School and the three intermediate years at sea. The School was placed under the supervision of the Bureau of Ordnance and Hydrography, and its name was changed to the United States Naval Academy. The corps of professors was enlarged, the course was extended, and the system of separate departments, with executive heads, was fully adopted. It was provided that a Board of Visitors should make an annual inspection of the Academy, and report upon its condition to the Secretary of the Navy. A suitable vessel was attached to the Academy as a practice-ship, and the annual practice-cruises were begun.

After the system had been in operation a year new changes were proposed, and the recommendations of the Academic Board on the subject were referred to the Board of Examiners of the year 1851, composed of the following officers:

Commodore David Conner,
Captain Samuel L. Breese,
Commander C. K. Stribling,
Commander A. Bigelow,
Commander Franklin Buchanan,
Lieutenant Thomas T. Craven.

The change recommended by the Board of Examiners, and adopted by the Department, consisted mainly in leaving out the requirement of three years of sea-service in

the middle of the course, thus making the four years of study consecutive. The practice-cruises supplied the place of the omitted sea-service, and gave better opportunities of training. The change went into operation in November, 1851, together with other improvements recommended by the Board. The system has continued, with slight modifications, to the present time. The first class to receive the benefit of it was that which entered in 1851. Six members of this class completed the course in three years, and graduated in June, 1854; the rest of the class followed in 1855.

In May, 1861, on the outbreak of the war, the Academy was removed to Newport, R. I. The three upper classes were detached and ordered to sea, and the remaining Acting Midshipmen were quartered in the Atlantic House and on board the frigates Constitution and Santee. In September, 1865, the Academy was moved back to Annapolis, where it has since remained.

When the Bureau of Navigation was established, July 5, 1862, the Academy was placed under its supervision; March 1, 1867, it was placed under the direct care and supervision of the Navy Department, the administrative routine and financial management being still conducted through the Bureau. On the 11th of March, 1869, all official connection with the Bureau came to an end.

The term of the academic course was changed by law, March 3, 1873, from four to six years. The change took effect with the class which entered in the following summer.

In 1866, a class of Acting Third Assistant Engineers was ordered to the Academy for instruction. The course embraced the subjects of steam-engineering, iron-manufacture, chemistry, and mechanics, and practical exercises with the steam-engine and in the machine-shop. This class graduated in June, 1868, together with two Cadet-Engineers who had entered the Academy in 1867. After an interval of four years, in October, 1871, a new class of Cadet-Engineers were admitted. This class followed a two years' course, somewhat more extended than that of the class of 1868, and graduated in 1873. In 1872 and 1873, new classes were admitted, the first of which left the Academy in 1874 and the second in 1875. By an act of Congress approved February 24, 1874, the course of instruction for Cadet-Engineers was made four years instead of two; and the new provision was first applied to the class entering the Academy in the year 1874.

BOARD OF VISITORS, JUNE, 1878.

Rear-Admiral JOHN L. WORDEN, U. S. N., *President.*
Brevet Major-General J. C. DAVIS, U. S. A., *Vice-President.*
Captain CLARK H. WELLS, U. S. N.
Honorable DANIEL S. PRINTUP, of Georgia.
Professor C. M. WOODWARD, Washington University, Saint Louis, Mo.
Honorable ALEXANDER BROWN, South Carolina.
Colonel ISAAC H. REED, New York.
W. H. PARKER, President of Maryland Agricultural College.
Chief-Engineer B. F. ISHERWOOD, U. S. N.
Reverend G. M. T. WRIGHT, Minnesota.
Honorable JOHN HANCOCK, Texas.
P. O. HOOPER, M. D., Arkansas.
Captain K. R. BREESE, U. S. N.
Reverend A. WHEELER, LL.D., Pennsylvania.
Brevet Major-General WAGER SWAYNE, U. S. A.

ACADEMIC CALENDAR.

1878-79.

1878.		
Oct.	1.—Beginning of first term	Tuesday.
1879.		
Jan. 27–Feb.	1.—Semi-annual examination	Monday–Saturday.
Feb.	1.—End of first term	Saturday.
June	2–10.—Annual examination	Monday–Tuesday.
June	10.—End of academic year 1878–79	Tuesday.
June	11.—Examination of candidates for admission as Cadet-Midshipmen	Wednesday.
Sept.	15.—Examination of candidates for admission as Cadet-Engineers	Monday.
Sept.	22.—Examination of candidates for admission as Cadet-Midshipmen	Monday.
Oct.	1.—Beginning of first term 1879–80	Wednesday.

The academic months end on the following days:

1878–79.

October	Nov. 2	February	Mar. 1
November	Nov. 30	March	Mar. 29
December	Dec. 28	April	April 26
January	Jan. 25	May	May 31

SEPTEMBER.

Sun.	M.	T.	W.	T.	F.	Sat.
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	....	....	....	....	....
....	....	....	....	....	....	....

OCTOBER.

....	....	1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31	....	....

NOVEMBER.

....	....	....	....	....	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

DECEMBER.

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31	....	....	....	....

JANUARY.

....	....	....	1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	....

FEBRUARY.

....	....	....	....	....	....	1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	....

MARCH.

Sun.	M.	T.	W.	T.	F.	Sat.
....	....	....	....	....	....	1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31	....	....	....	....	....

APRIL.

....	....	1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	....	....	....

MAY.

....	....	....	....	1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

JUNE.

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	....	....	....	....	....

SEPTEMBER.

....	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	....	....	....	....

OCTOBER.

....	....	....	1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	....

OFFICERS

OF THE

UNITED STATES NAVAL ACADEMY.

COMMODORE F. A. PARKER,
SUPERINTENDENT.

COMMANDER S. D. GREENE,
Senior Aid to the Superintendent.

LIEUTENANT H. PERKINS,
Aid to the Superintendent.

ACADEMIC STAFF.

COMMANDER F. V. McNAIR,
Commandant of Cadets.

LIEUTENANT W. H. BROWNSON,
Assistant to the Commandant of Cadets.

SEAMANSHIP, NAVAL TACTICS, AND NAVAL CONSTRUCTION.

COMMANDER E. M. SHEPARD,
Head of Department.

LIEUTENANT-COMMANDER C. V. GRIDLEY,
LIEUTENANT-COMMANDER C. J. TRAIN
LIEUTENANT W. H. EMORY,
LIEUTENANT L. C. LOGAN,
Instructors in Seamanship, Naval Tactics, and Naval Construction.

MATTHEW STROHM,
Instructor in Boxing, Swimming, and Gymnastics.

ORDNANCE AND GUNNERY.

COMMANDER A. T. MAHAN,
Head of Department.

LIEUTENANT J. C. SOLEY,
LIEUTENANT W. H. PARKER, JR.,
LIEUTENANT J. W. MILLER,
LIEUTENANT DUNCAN KENNEDY,
Instructors in Naval Gunnery, and Infantry Tactics.

ANTOINE J. CORBESIER,
Sword-Master.

JEAN B. RETZ,
GEORGE HEINTZ,
Assistant Sword-Masters.

MATHEMATICS.

PROFESSOR W. W. HENDRICKSON,
Head of Department.

LIEUTENANT-COMMANDER F. W. DICKINS.
LIEUTENANT SOCRATES HUBBARD, A. M..
LIEUTENANT R. R. INGERSOLL,
LIEUTENANT S. C. PAINE.
LIEUTENANT H. O. RITTENHOUSE,
MASTER G. L. DYER.
MASTER C. W. BARTLETT.
ENSIGN A. C. HODGSON,
Instructors in Mathematics.

STEAM-ENGINEERING.

CHIEF ENGINEER J. P. SPRAGUE,
Head of Department.

PASSED ASSISTANT ENGINEER L. W. ROBINSON, C. E., M. M. E..
PASSED ASSISTANT ENGINEER C. H. GREENLEAF,
PASSED ASSISTANT ENGINEER W. L. NICOLL,
PASSED ASSISTANT ENGINEER DAVID JONES,
PASSED ASSISTANT ENGINEER C. H. MANNING,
PASSED ASSISTANT ENGINEER G. H. KEARNY,
ASSISTANT ENGINEER A. V. ZANE,
Instructors in Steam-Engineering.

ASTRONOMY, NAVIGATION, AND SURVEYING.

COMMANDER J. A. HOWELL,
Head of Department.

LIEUTENANT-COMMANDER A. D. BROWN,
LIEUTENANT W. J. BARNETTE.
LIEUTENANT C. G. BOWMAN,
Instructors in Astronomy, Navigation, and Surveying.

PHYSICS AND CHEMISTRY.

COMMANDER W. T. SAMPSON,
Head of Department.

LIEUTENANT-COMMANDER W. M. FOLGER,
PROFESSOR H. D. TODD,
MASTER S. A. STAUNTON.
ENSIGN A. A. MICHELSON,
PROFESSOR N. M. TERRY, A. M., PH. D.,
PROFESSOR C. E. MONROE, S. B.,
Instructors in Physics and Chemistry.

MECHANICS AND APPLIED MATHEMATICS.

PROFESSOR J. M. RICE, S. B..
Head of Department.

LIEUTENANT M. R. S. MACKENZIE,
LIEUTENANT S. W. VERY.
LIEUTENANT HARRY KNOX.
Instructors in Mechanics and Applied Mathematics.

ENGLISH STUDIES, HISTORY, AND LAW.

PROFESSOR J. R. SOLEY, A. B.,
Head of Department.

LIEUTENANT J. M. MILLER,
LIEUTENANT F. M. WISE.
LIEUTENANT J. V. B. BLEECKER.
LIEUTENANT R. T. JASPER,
LIEUTENANT G. W. TYLER.
MASTER C. H. LYMAN,
MASTER C. R. MILES.
ASSISTANT PROFESSOR W. W. FAY, A. M.,
Instructors in English Studies, History, and Law.

MODERN LANGUAGES.

PROFESSOR L. F. PRUD'HOMME, A. M.,
Head of Department.

LIEUTENANT R. C. DERBY,
LIEUTENANT A. B. SPEYERS.
LIEUTENANT A. P. NAZRO,
MASTER AARON WARD,
MASTER W. P. CLASON,
ASSISTANT PROFESSOR A. V. S. COURCELLE,
ASSISTANT PROFESSOR EUGENE DOVILLIERS,
ASSISTANT PROFESSOR JULES LEROUX,
ASSISTANT PROFESSOR HIPPOLYTE DALMON,
Instructors in French and Spanish.

PROFESSOR PEDRO MONTALDO,
Instructor in Spanish.

DRAWING.

PROFESSOR MARSHAL OLIVER,
Head of Department.

ASSISTANT PROFESSOR C. F. BLAUVELT, N. A.,
Instructor in Drawing.

OFFICERS NOT ATTACHED TO THE ACADEMIC STAFF.

COMMANDER MERRILL MILLER, *In Charge of Practice Ships.*
MEDICAL INSPECTOR A. L. GIHON, A. M., M. D.
PASSED ASSISTANT SURGEON W. A. CORWIN, M. D.
PASSED ASSISTANT SURGEON G. E. HARMON, M. D.
PASSED ASSISTANT SURGEON E. H. GREEN, M. D.
ACTING ASSISTANT SURGEON T. O. WALTON, M. D.
PAYMASTER A. S. KENNY, A. B., *Commissary.*
PAYMASTER F. H. SWAN, *Storekeeper.*
PAYMASTER W. N. WATMOUGH, *Treasurer.*
CHAPLAIN ROBERT HUDSON, M. A.
ASSISTANT PROFESSOR THOMAS KARNEY, A. M., *Librarian.*
J. J. GRAFF, *Assistant Librarian.*
R. M. CHASE, *Secretary.*

MARINE GARRISON.

CAPTAIN G. P. HOUSTON, *Commanding.*
FIRST LIEUTENANT S. H. GIBSON.
SECOND LIEUTENANT S. J. LOGAN.

BOATSWAIN C. E. HAWKINS.
GUNNER ROBERT SOMMERS.

MATES.

C. J. MURPHY, SAMUEL GEE, WILLIAM G. SMITH, L. M. MELCHER — *Attached to the United States Gunnery-ship Santee and to the Sloop-of-war Dale.*

ROBERT SILVER — *Attached to the United States Steamer Nantucket (iron-clad).*

BENJAMIN G. PERRY, JOSEPH RODGERS — *Attached to the United States Steamer Phlox (steam-tender).*

ACADEMIC BOARD.

COMMODORE F. A. PARKER, U. S. N.
COMMANDER F. V. McNAIR, U. S. N.
COMMANDER J. A. HOWELL, U. S. N.
COMMANDER A. T. MAHAN, U. S. N.
COMMANDER W. T. SAMPSON, U. S. N.
COMMANDER E. M. SHEPARD, U. S. N.
PROFESSOR W. W. HENDRICKSON, U. S. N.
CHIEF ENGINEER J. P. SPRAGUE, U. S. N.
PROFESSOR J. M. RICE, S. B., U. S. N.
PROFESSOR J. R. SOLEY, A. B., U. S. N.
PROFESSOR L. F. PRUD'HOMME, A. M.
PROFESSOR MARSHAL OLIVER.

CADET-OFFICERS.

CADET-LIEUTENANT-COMMANDER.

RANDOLPH H. MINER.

CADET-LIEUTENANTS.

T. SNOWDEN.
J. M. MOORE.
C. C. MARSH.
L. O. GARRETT.

CADET-MASTERS.

E. E. HAYDEN.
C. H. HARLOW.
L. M. GARRETT.
H. S. CHASE.

R. S. SLOAN, *Adjutant.*

CADET-ENSIGNS.

A. C. CUNNINGHAM.
J. P. CAHOON.
R. P. SCHWERIN.
G. W. BROWN.

CADET-PETTY-OFFICERS.

First Captains of Gun's Crews.

E. H. Tillman.
J. A. Mudd.
W. A. Thom.
A. B. Clements.
D. P. Menefee.
G. S. Welsh.
J. A. Dougherty.
P. L. Drayton.
C. W. Jungen.
J. B. Blish.
J. H. Gibbons.
W. A. Gill.
C. S. Ripley.
J. Gibson.
H. Wike.
H. J. Robinson.

Second Captains of Gun's Crews.

R. Bitler.
E. Wilkinson.
J. A. Bell.
W. J. Sears.
R. F. Lopez.
L. H. Barnard.
W. A. Graham.
M. L. Read.
P. R. Alger.
H. G. Dresel.
L. S. Norton.
J. B. Bernadou.
W. H. Wolfersberger.
A. A. Ackerman.
P. W. Hourigan.
H. Phelps.

CADET-PASSED-ASSISTANT-ENGINEER.

H. P. NORTON.

CADET-ASSISTANT-ENGINEERS.

G. R. SALISBURY,
H. S. ELSEFFER.

Cadet-Machinists.

B. C. Bryan.
J. W. Annan.
J. U. Crygier.
F. M. Bennett.
E. O'C. Acker.
W. M. McFarland.
C. B. Lubbe.
R. T. Isbester.

CADET-MIDSHIPMEN.

Graduating class of 1878—36 *members.*

Order of general merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit in—								Number of demerits.	Sea-service in practice-ships.	
				Years.	Months.	Seamanship.	Naval construction.	Ordnance.	Marine engines.	Navigation.	Light and heat.	Law.	Spanish.		Months.	Days.
*1	**Fillmore, John Hudson**	Illinois	Sept. 24, 1874	17	10	2	2	2	1	5	2	3	11	51	5	18
*2	**Rodgers, Thomas Slidell**	At large	Sept. 24, 1874	16	1	6	6	3	5	1	4	1	1	51	5	18
*3	**Quinby, John Gardner**	At large	June 12, 1874	14	10	3	5	3	2	7	1	10	16	108	5	18
*4	**McClain, Charles Sumner**	Indiana	Nov. 2, 1874	17	2	4	8	1	2	1	7	6	6	86	5	18
*5	**Glennon, James Henry**	California	Sept. 24, 1874	17	7	32	9	18	6	6	4	12	3	62	5	18
6	Knapp, Harry Shepard	Connecticut	June 26, 1874	18	0	13	15	9	7	11	10	2	7	125	5	18
7	Sprague, Frank Julian	Massachusetts	Sept. 29, 1874	17	2	8	1	6	4	8	3	13	20	132	5	18
8	Smith, Roy Campbell	Virginia	Oct. 3, 1874	16	2	16	12	16	11	12	14	21	14	40	5	18
9	Rodgers, William Ledyard	California	June 11, 1874	14	4	15	18	7	9	3	9	15	15	89	5	7
10	Wood, Albert Norton	Indiana	Sept. 24, 1873	16	6	1	3	10	12	9	10	19	13	53	5	26
11	Huse, Harry McLaren Pinkney	New York	Sept. 30, 1874	15	10	31	21	13	12	17	12	3	2	82	5	18
12	Ormsby, George Francis	Ohio	Sept. 24, 1873	17	4	25	4	30	21	27	18	15	5	57	5	26
13	Atwater, Charles Nelson	New York	Sept. 24, 1873	16	3	11	17	21	24	19	22	3	16	56	7	26
14	Lloyd, Edward, jr	Maryland	June 17, 1874	16	11	12	14	3	14	13	20	14	33	57	5	18
15	Holcombe, John Hite Lee	Georgia	June 27, 1874	17	9	13	7	8	22	23	36	6	27	21	5	18
16	Hughes, Richard Morris	Pennsylvania	Sept. 25, 1874	15	8	28	16	20	20	10	4	8	4	114	5	18
17	Bibb, Peyton Benajah	Alabama	June 12, 1874	17	3	9	20	11	14	25	16	10	18	33	5	18
18	Wright, Robert Kemp	Pennsylvania	June 12, 1873	14	8	5	11	14	10	22	26	22	10	83	7	26
19	Kimmell, Harry	Pennsylvania	Sept. 28, 1874	14	5	33	18	25	8	4	8	23	9	90	5	18
20	Biddle, Spencer Fullerton Baird	At large	June 13, 1874	15	5	7	30	23	22	16	17	9	22	74	5	18
21	Ryan, Thomas William	Pennsylvania	June 13, 1873	16	11	29	22	26	27	29	30	29	33	127	7	26

22	McDonnell, John Edmund	Nevada	Sept. 30, 1874	16	4	23	24	17	16	14	15	27	8	77	5	18
23	Canfield, William Chase	At large	Sept. 23, 1873	16	1	30	31	28	25	34	29	30	12	60	7	26
24	Stafford, George Henry	Iowa	June 10, 1874	17	11	19	25	12	17	30	28	17	18	49	5	18
25	White, William Porter	At large	June 30, 1874	15	5	17	34	24	32	26	19	33	21	128	5	18
26	Clark, George Ramsey	Ohio	June 9, 1874	17	3	10	10	29	17	23	13	18	23	111	5	18
27	Sparhawk, George	Massachusetts	Sept. 24, 1874	17	6	18	26	21	31	21	34	28	32	105	5	18
28	Craven, John Eccleston	At large	Sept. 24, 1874	15	10	27	28	26	27	15	26	33	30	107	5	18
29	Shipley, John Harry	Missouri	Sept. 30, 1874	16	6	21	23	30	26	27	23	31	27	87	5	18
30	Rogers, Allen Grey	North Carolina	June 12, 1874	14	6	21	13	15	30	19	21	24	26	123	6	18
31	Knapp, John Joseph	Missouri	June 9, 1874	16	8	35	33	33	36	18	31	20	36	87	5	18
32	Todd, Wilson Lemuel	Pennsylvania	June 5, 1873	15	1	19	36	34	27	33	23	25	30	134	3	18
33	Hooke, Horatio Hill	Illinois	Sept. 26, 1874	17	0	23	28	19	33	35	31	25	23	119	5	18
34	Hetherington, James Henry	Iowa	June 9, 1874	17	7	34	27	32	35	32	33	36	29	122	5	18
35	Dent, Baine Caruthers	At large	June 5, 1873	16	7	25	31	34	19	31	25	32	23	128	7	27
36	Almy, Augustus Craven	At large	June 6, 1872	15	6	36	35	36	34	36	35	35	33	104	9	12

CADET-MIDSHIPMEN.

First class—41 members.

Order of annual merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit in—										Number of demerits.	Sea-service in practice-ships.	
				Years.	Months.	Seamanship.	Naval tactics.	Ordnance instructions.	Infantry tactics.	Astronomy.	Electricity.	Calculus and mechanics.	English composition.	French.	Spanish.		Months.	Days.
37	Barnard, Louis Hull	Colorado	June 13, 1874	16	11	25	20	32	30	37	37	39	38	24	36	194	4	19
34	Bell, John Arthur	West Virginia	June 13, 1874	16	11	41	15	29	39	36	17	25	41	38	38	142	4	19
38	Bitler, Reuben Oscar	Pennsylvania	June 19, 1875	16	1	40	33	40	37	39	39	33	35	29	33	173	2	19
8	Blish, John Bell	Indiana	Sept. 15, 1875	15	0	15	2	19	13	11	1	7	26	6	10	123	4	19
30	Brown, Guy Warner	Indiana	June 19, 1875	17	2	27	22	22	33	23	22	32	40	26	24	133	4	19
19	Cahoon, James Blake	Vermont	June 10, 1874	17	6	9	11	13	18	21	19	21	15	32	24	101	4	19
5	Chase, Henry Sanders	Louisiana	June 21, 1875	16	10	14	18	10	10	5	4	6	8	9	4	216	4	19
*3	**Clements, Abner Brush**	Missouri	June 21, 1875	17	6	17	6	16	6	2	2	1	4	15	12	117	4	19
23	Cunningham, Andrew Chase	New York	June 9, 1874	16	4	16	9	15	1	28	33	37	23	34	26	47	4	19
32	Dougherty, John Allen	Missouri	June 12, 1874	16	9	35	19	35	29	38	27	21	29	40	21	76	4	19
26	Drayton, Percival Langdon	At large	June 10, 1874	16	2	28	27	25	41	28	26	24	17	4	32	191	4	19
7	Garrett, Le Roy Mason	New York	Sept. 16, 1875	18	0	9	4	9	12	9	6	9	11	1	2	86	4	19
17	Garrett, Leigh Osborn	Illinois	Sept. 13, 1875	15	1	4	1	33	16	18	14	25	36	26	15	156	4	19
25	Gibbons, John Henry	Michigan	Sept. 15, 1875	16	8	30	29	19	26	31	31	34	3	28	16	193	4	19
22	Gibson, John	Kentucky	Feb. 16, 1874	18	0	25	12	30	17	11	24	17	38	38	28	85	4	19
18	Gill, William Andrew	Pennsylvania	June 21, 1875	16	5	20	12	38	36	10	9	15	11	18	18	182	4	19
39	Graham, William Alfred	New York	Sept. 28, 1874	14	11	39	41	30	34	42	41	41	20	36	40	174	4	19
13	Harlow, Charles Henry	New York	Sept. 15, 1875	17	0	3	17	8	7	15	20	17	22	10	9	182	4	19
*2	**Hayden, Edward Everett**	Massachusetts	June 21, 1875	16	2	12	8	6	28	4	7	4	1	2	1	81	4	19
*4	**Hood, John**	Alabama	Sept. 15, 1875	15	9	7	6	10	22	2	3	2	7	12	8	165	4	19
11	Jungen, Charles William	Wisconsin	Sept. 24, 1874	15	6	13	16	5	9	16	17	8	17	13	14	109	4	19
28	Kellogg, Francis Woodruff	Connecticut	June 21, 1875	17	10	37	22	19	32	19	29	21	15	31	26	116	4	19

27	Lopez, Robert Files	Tennessee	Sept. 29, 1874	17	6	32	35	36	39	20	28	19	23	22	21	115	4	19
9	Marsh, Charles Carleton	Indiana	Sept. 14, 1875	17	1	1	3	3	4	6	9	10	26	5	6	170	4	19
16	Menefee, Daniel Preston	California	Sept. 25, 1874	16	6	11	12	16	23	14	24	25	28	10	6	104	4	19
*1	**Miner, Randolph Huntington**	Ohio	June 19, 1875	15	7	6	10	1	2	1	5	3	6	3	3	59	4	19
6	Moore, John McConnell	Indiana	June 21, 1875	17	6	2	4	3	11	7	8	12	2	7	11	179	4	19
33	Mudd, John Alexis	At large	Sept. 11, 1875	15	3	21	31	14	31	34	33	37	19	35	41	194	4	19
41	Purcell, John Lewis	New Jersey	Sept. 29, 1873	17	4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5	8
36	Read, Maurice Lance	South Carolina	Sept. 28, 1874	15	10	32	39	34	15	35	38	40	34	25	31	121	4	19
15	Ripley, Charles Stedman	At large	June 17, 1875	17	11	18	21	18	21	23	16	13	5	17	28	130	4	19
31	Robinson, Herbert Judson	New Hampshire	Sept. 15, 1875	16	6	37	35	36	37	26	35	28	25	16	5	187	4	19
14	Schwerin, Rennie Pierre	New York	Sept. 25, 1874	16	1	8	30	7	7	16	12	19	31	23	12	102	4	19
20	Sears, Walter Jesse	Pennsylvania	June 21, 1875	17	8	34	26	28	20	23	22	14	9	13	19	130	4	19
12	Sloan, Robert Sage	New York	June 21, 1875	15	7	5	22	2	5	13	13	11	20	30	23	128	4	19
21	Snowden, Thomas	New York	June 21, 1875	17	10	23	37	10	3	22	31	30	14	20	16	66	4	19
40	Sturdivant, Harry Leland	Maine	June 13, 1874	17	8	18	42	42	42	28	40	28	42	42	.....	327	2	19
29	Thom, William Arthur	At large	June 21, 1875	17	8	31	32	25	19	33	20	34	31	19	28	84	4	19
24	Tillman, Edwin Hord	Tennessee	Sept. 14, 1874	16	10	24	38	25	34	27	11	16	31	41	39	163	4	19
35	Welsh, George Silvis	Pennsylvania	Sept. 24, 1874	17	7	42	40	24	26	32	30	34	30	33	34	192	4	19
10	Wike, Harvey	Illinois	Sept. 16, 1875	14	5	35	33	39	23	8	15	5	10	20	37	165	4	19

CADET-MIDSHIPMEN.

Second class—66 members.

Order of annual merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit in—					Number of demerits.	Sea-service in practice-ships.	
				Years.	Months.	Mathematics.	Physics and chemistry.	History and rhetoric.	French.	Drawing.		Months.	Days.
6	Ackerman, Albert Ammerman	New Jersey	June 21, 1876	16	11	9	2	12	28	18	92	2	18
*1	**Alger, Philip Rounseville**	At large	Sept. 11, 1876	17	0	1	3	2	2	25	198	2	18
48	Ashmore, Henry Beckwith	At large	Oct. 3, 1876	15	4	47	45	49	35	51	258	2	18
63	Bailey, John Bellamy	Florida	Sept. 15, 1875	16	7	64	64	49	50	64	206	2	18
22	Beale, Joseph	Pennsylvania	Oct. 12, 1874	14	10	23	15	13	26	58	239	2	18
49	Belmont, Oliver Hazard Perry	New York	Sept. 30, 1874	14	10	58	36	59	8	45	268	2	19
*4	**Bernadou, John Baptiste**	At large	Sept. 12, 1876	17	10	5	7	9	4	1	169	2	18
30	Bowdon, Frank Welch	Texas	Sept. 11, 1875	17	7	42	40	4	21	57	106	2	18
32	Brainard, Frederick Roland	Illinois	June 21, 1876	17	9	26	33	52	45	13	126	2	18
56	Brinley, Edward	At large	Sept. 18, 1876	16	3	50	59	48	63	52	97	2	18
55	Brown, James Stephen	Tennessee	Sept. 11, 1875	17	2	44	58	56	48	58	264	2	18
§	Buchanan, Wilson Wildman	Ohio	June 19, 1875	17	3	.....	.....	.....	.....	.....	81	2	19
59	Bullitt, Howard Henry	Kentucky	Sept. 11, 1875	17	11	51	62	49	58	55	100	2	18
33	Cabaniss, Charles	Virginia	June 21, 1876	16	8	45	40	11	11	50	23	2	18
43	Clark, Lewis Jacob	Alabama	Sept. 11, 1876	14	7	40	32	43	54	38	214	2	18
62	Cooke, Paul Byram	At large	Sept. 13, 1875	16	4	60	65	62	51	52	240	2	18
42	Cramer, Ambrose	Maryland	Sept. 28, 1874	17	6	34	55	56	51	15	154	2	19
46	Dewey, Theodore Gibbs	South Carolina	June 19, 1875	16	0	52	55	45	38	19	221	2	18
20	Dickson, Joseph Morrill	Texas	June 14, 1876	15	5	21	33	7	22	61	66	2	18
13	Dillman, George Lincoln	Iowa	June 19, 1876	16	1	11	21	33	16	10	139	2	18
24	Drake, James Calhoun	Arkansas	June 19, 1875	17	11	14	36	43	56	32	160	2	18
*2	**Dresel, Herman George**	Ohio	Sept. 18, 1876	17	8	3	1	2	1	2	188	2	18

25	Duncan, Louis	Kentucky	Sept. 11, 1876	15	6	19	22	34	58	24	164	2	18
23	Emerson, William Henry	At large	Oct. 10, 1876	16	4	33	10	32	31	15	136	2	18
34	Eyre, Manning Kenard	At large	Sept. 11, 1876	15	6	39	30	28	12	34	252	2	18
37	Fillebrown, Horatio Ladd	South Carolina	June 19, 1875	16	1	36	52	37	42	10	117	2	18
54	Finley, Henry Marzette	Ohio	June 21, 1875	16	5	55	28	30	13	48	273	2	18
21	French, George Ross	At large	June 21, 1875	17	11	17	23	22	54	40	192	5	7
§	Gorgas, Miles Carpenter	At large	Sept. 11, 1875	14	2	.....	.....	.....	.....	.....	199	2	19
57	Gray, James	Illinois	Sept. 12, 1876	17	8	58	26	61	58	46	236	2	18
38	Haeseler, Francis Joy	Pennsylvania	Sept. 12, 1876	16	5	35	47	41	45	6	176	2	18
12	Haskell, Porter David	Michigan	Sept. 12, 1876	17	4	13	13	17	14	36	76	2	18
61	Hill, Charles Homer	Wisconsin	Sept. 14, 1875	16	0	61	51	63	47	68	621	2	0
7	Hourigan, Patrick William	New York	June 21, 1876	16	7	7	12	1	23	22	269	2	18
11	Howze, Arthur Robertson	Mississippi	June 21, 1876	15	7	9	24	39	3	27	86	2	18
41	Huntoon, Fitz-Aubert	Texas	Sept. 15, 1875	16	10	36	47	46	41	32	229	2	18
60	Levisee, Leonidas	Louisiana	June 21, 1875	17	6	64	60	56	28	31	163	2	18
40	Lieper, Edwards Fayssoux	Pennsylvania	June 21, 1875	16	7	48	28	40	34	5	72	2	18
51	Luby, John Frazer	New York	June 21, 1875	17	11	54	54	52	56	61	236	2	19
31	Maxwell, William John	At large	June 9, 1874	15	2	25	44	28	33	41	130	2	18
29	Mayer, Augustus Newkirk	Iowa	June 17, 1876	17	3	30	18	26	39	39	191	2	18
14	Morgan, Stokely	Arkansas	June 14, 1876	16	11	14	17	20	35	26	72	2	18
16	Muir, William Carpenter Pendleton	Kentucky	June 21, 1876	17	3	18	30	15	9	30	140	2	18
50	Nash, Edwin White	Ohio	Sept. 11, 1876	16	11	49	53	52	65	65	240	2	18
15	Niblack, Albert Parker	Indiana	Sept. 12, 1876	17	2	23	14	4	22	22	58	2	18
*3	**Norton, Luman Spooner**	Vermont	Sept. 12, 1876	17	0	2	5	7	26	8	188	2	18
17	Parke, Thomas Aloysius	West Virginia	June 21, 1876	16	8	20	24	22	7	47	143	2	18
8	Phelps, Harry	New Jersey	Sept. 13, 1876	15	7	6	15	24	15	37	191	2	18
	Poundstone, Homer Clarke	West Virginia	Sept. 24, 1874	14	0	.....	.....	.....	.....	.....	49	2	19
47	Richardson, Walter Gates	Massachusetts	Sept. 12, 1876	16	9	55	45	34	30	54	232	2	18
58	Rodman, Hugh	Kentucky	Sept. 13, 1875	16	8	57	49	65	44	61	227	2	18
19	Rohrbacker, Joseph Hamilton	Pennsylvania	June 21, 1876	17	9	31	20	6	17	66	101	2	18
27	Safford, William Edwin	Ohio	Sept. 11, 1876	16	9	52	6	27	6	6	108	2	18
35	Scott, Richard Hamilton	Minnesota	June 21, 1876	17	9	31	42	37	37	28	137	2	18
36	Sims, William Sowden	Pennsylvania	June 21, 1876	17	8	27	49	59	48	3	205	2	18
39	Simpson, Edward, Jr.	At large	June 21, 1876	15	9	41	43	34	42	20	99	2	18

CADET-MIDSHIPMEN.

Second class—66 *members*—Continued.

Order of annual merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit in—					Number of demerits.	Sea-service in practice-ships.	
				Years.	Months.	Mathematics.	Physics and chemistry.	History and rhetoric.	French.	Drawing.		Months.	Days.
45	Swift, Franklin	Massachusetts	June 9, 1874	16	1	46	39	41	58	49	194	2	19
53	Truxtun, William	At large	June 21, 1876	15	3	27	33	14	67	4	194	2	18
26	Van Duzer, Louis Sayre	New York	Sept. 13, 1876	15	3	38	8	19	64	10	133	2	18
28	Wall, Francis Richardson	Mississippi	June 23, 1876	16	11	29	36	17	20	40	135	2	18
18	Watters, John Sproston	At large	June 21, 1876	14	11	22	26	15	17	8	185	2	18
64	Webster, Edwin Belden	Connecticut	Sept. 28, 1874	16	6	67	67	67	65	56	307	2	19
10	West, George Ernest	New York	Sept. 12, 1876	14	5	8	8	31	17	43	105	2	18
9	Wilkinson, Ernest	Louisiana	June 19, 1875	17	2	16	4	20	9	21	218	2	19
5	Wolfersberger, William Henry	Illinois	Sept. 12, 1876	17	7	4	11	9	23	15	94	2	18
44	Worthington, Thomas	Alabama	June 19, 1876	16	7	43	55	47	23	42	166	2	18

§ Turned back from the first class.

CADET-MIDSHIPMEN.

Third class—85 members.

Order of annual merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit in—				Number of demerits.	Sea-service in practice-ships.	
				Years.	Months.	Mathematics.	English and history.	French.	Drawing.		Months.	Days.
15	Andrews, Horace Burlingame	Michigan	June 22, 1876	15	1	12	22	9	26	48	2	0
21	Babcock, William Frederick	Louisiana	Sept. 19, 1876	15	8	16	21	29	46	37	2	0
24	Ballentine, Henry Laird	Tennessee	June 20, 1877	16	6	25	11	14	75	122	2	0
62	Barnett, George	Wisconsin	June 19, 1877	17	6	65	41	74	70	43	2	0
51	Blow, George Preston	Virginia	Sept. 14, 1876	15	11	50	61	69	16	133	2	0
†	Bontils, Thomas Lewis	Missouri	June 19, 1875	17	8	.....	.....	.....	.....	.....	0	0
19	Bryan, Samuel	Maryland	June 14, 1876	17	3	20	17	15	20	127	2	0
69	Buck, Guy Morville	Maine	Sept. 11, 1877	16	10	70	73	69	78	48	2	0
35	Bunts, Frank Emory	Ohio	June 20, 1877	16	1	30	37	39	41	37	2	0
29	Capehart, Edward Everett	Ohio	June 22, 1877	17	11	44	17	13	63	22	2	0
9	Carroll, Eugene	At large	June 19, 1877	16	2	6	15	23	29	129	2	0
60	Clarke, George	Illinois	June 22, 1877	14	11	58	70	69	45	94	2	0
41	Cockle, Rudolphus Rouse	Illinois	June 21, 1875	17	8	35	29	29	37	280	2	0
53	Cohen, Harry Radcliffe	At large	June 20, 1877	15	4	63	46	43	25	19	2	0
49	Colwell, James Ham	At large	June 20, 1877	16	10	52	34	56	63	50	2	0
78	Cooke, Abbott Stanislaus	Illinois	June 26, 1877	17	11	73	73	63	16	221	0	0
47	Craig, Ben Holliday	Missouri	June 14, 1876	16	8	42	40	29	82	139	2	0
46	Craven, Macdonough	New York	June 21, 1876	17	7	51	59	49	7	268	2	0
54	Crenshaw, James Davis	Texas	Sept. 11, 1877	17	10	53	67	32	54	33	2	0
11	Dashiell, Robert Brooke	At large	June 19, 1877	16	11	25	4	5	3	22	2	0
66	Donnelly, Michael Joseph	Wisconsin	June 21, 1877	17	7	67	57	61	57	163	2	0
14	Doyen, Charles Augustus	New Hampshire	June 21, 1876	16	9	13	19	10	8	160	2	0
48	Dresser, James Walter	Minnesota	June 21, 1877	16	8	44	51	66	39	168	2	0

CADET-MIDSHIPMEN.

Third class—85 *members.*—Continued.

Order of annual merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit in—				Number of demerits.	Sea-service in practice-ships.	
				Years.	Months.	Mathematics.	English and history.	French.	Drawing.		Months.	Days.
10	Eldridge, Honston	At large	Oct. 2, 1876	15	7	10	12	12	22	115	2	0
42	Emmet, William LeRoy	At large	June 26, 1876	16	11	42	41	63	9	290	2	0
76	Enouye, Yonoske	Empire of Japan	Sept. 18, 1877	19	.....	79	82	.....	67	9	0	0
25	Flournoy, William Francis	Louisiana	June 19, 1877	17	9	11	30	43	72	188	2	0
68	Ford, William Griffing	Arkansas	Sept. 11, 1877	15	7	56	76	73	62	176	2	0
79	Forrest, Rutherford Worster	New York	Sept. 12, 1877	16	2	80	77	47	79	325	0	0
17	Forshew, Robert Pierpont	New York	June 21, 1876	16	11	22	7	26	46	53	2	0
56	Foster, Edward West	Tennessee	June 21, 1876	16	1	49	60	55	61	278	2	0
36	George, Charles Peaslee	Illinois	July 1, 1876	16	3	32	37	54	15	127	2	0
§	Gresham, William Albert	Indiana	June 19, 1875	17	3	.....	.....	.....	.....	.....	0	0
71	Gurley, Revere Randolph	District of Columbia	Sept. 11, 1877	16	1	.....	.....	.....	65	262	0	0
8	Haines, Henry Cargill	At large	June 26, 1875	15	7	8	19	24	4	166	2	0
40	Hains, Robert Peter	Maine	Sept. 18, 1876	16	3	47	41	49	10	181	2	0
64	Harmon, Eugene Marion	Ohio	June 20, 1877	17	10	69	32	58	59	237	2	0
52	Harrison, Edward Hanson	At large	June 21, 1877	15	10	53	44	75	42	53	2	0
†	Hasson, Alexander Ritchie	At large	June 21, 1875	15	4	.....	.....	.....	.....	.....	0	0
4	Hoogewerff, John Adrian	At large	June 21, 1877	16	7	5	12	26	24	67	2	0
22	Hunicke, Felix Harman	Missouri	Sept. 11, 1877	17	6	41	26	5	1	48	2	0
16	Karmany, Lincoln	Pennsylvania	Sept. 12, 1877	17	0	27	7	16	23	50	2	0
55	Kase, Spencer Mettler	Illinois	Sept. 11, 1877	17	10	66	44	43	27	54	2	0
61	Kimball, John Arthur	Massachusetts	Sept. 12, 1877	17	0	62	65	59	37	111	2	0
28	Lauchheimer, Charles Henry	Maryland	Sept. 11, 1877	17	11	35	24	4	65	109	2	0
63	Lindsey, John Howard	Pennsylvania	June 21, 1876	16	2	58	63	56	67	238	2	0

	Linnard, Joseph Hamilton	Pennsylvania	June 21, 1877	16	9	4	6	36	21	169	2	0
12	Mahoney, James Edward	Massachusetts	Sept. 12, 1876	16	9	22	1	8	19	92	2	0
30	Matthews, Thomas Henry	Pennsylvania	Sept. 12, 1876	16	1	32	24	16	30	259	2	0
18	McCrea, Alexander Sterling	At large	Oct. 2, 1876	17	2	28	10	7	11	241	2	0
65	McJunkin, Ira	Pennsylvania	June 20, 1877	17	4	74	50	72	56	20	2	0
75	McKee, Llewellyn Thomas	Pennsylvania	June 20, 1877	17	0	74	77	80	72	157	0	0
70	Morgan, Daniel	Kentucky	Sept. 11, 1877	17	10	70	75	77	80	203	2	0
50	Moses, Franklin James	South Carolina	Sept. 11, 1877	16	9	48	46	24	52	244	2	0
73	Oliphant, Alexander Coulter	New Jersey	Sept. 12, 1877	17	5	78	68	47	48	96	2	0
45	Orlopp, Max Anton	Arkansas	June 19, 1876	17	1	34	57	22	59	252	0	0
34	Parker, Felton	Iowa	Nov. 6, 1876	16	0	40	55	1	13	301	2	0
31	Parsons, Arthur Carlton	Iowa	June 21, 1876	17	11	22	46	34	33	154	2	0
§	Perkins, Con Marrast	Georgia	Sept. 11, 1875	14	11	.....	.....	.....	.....	235	2	18
§	Perry, George Ernest	Illinois	Sept. 12, 1876	16	10	.....	.....	.....	.....	451	0	0
26	Pierce, Byron Gilmore	Illinois	June 21, 1877	17	4	35	14	39	39	89	2	0
72	Porter, John Pryor	Texas	Sept. 11, 1875	16	2	70	53	42	76	113	2	0
59	Printup, David Lawrence	New York	June 21, 1877	17	5	56	69	63	43	189	2	0
*2	**Rees, John Levermore**	Michigan	June 21, 1877	17	4	2	2	19	2	72	2	0
7	Rider, Frederick Clinton	Rhode Island	Sept. 12, 1877	17	6	6	15	49	12	45	2	0
43	Robinson, William Moody	At large	June 23, 1876	17	4	44	31	66	36	198	2	0
38	Rodgers, Guy George	Tennessee	Sept. 23, 1876	14	1	19	39	26	77	232	2	0
58	Russell, William Worthington	At large	Sept. 12, 1876	17	9	63	35	3	83	299	2	0
*1	**Schock, John Loomis**	Pennsylvania	June 19, 1877	17	4	1	3	10	5	55	2	0
5	Serata, Tasuker	Empire of Japan	Sept. 12, 1877	19	0	3	27	49	54	27	2	0
32	Smies, Frederick William	Ohio	June 22, 1877	16	6	35	51	36	5	63	2	0
37	Stayton, William Henry	Delaware	June 21, 1877	16	3	31	23	59	67	135	2	0
33	Stewart, Charles West	Illinois	June 21, 1877	17	10	35	35	49	33	103	2	0
13	Sutton, Francis Eskridge	New York	June 21, 1877	16	6	15	5	2	71	84	2	0
20	Uriu, Sotokichi	Empire of Japan	Sept. 12, 1877	19	0	16	28	19	14	7	2	0
§	Vance, Zebulon Baird	North Carolina	June 22, 1876	16	0	.....	.....	.....	.....	246	2	18
67	Weeks, John Wingate	New Hampshire	June 21, 1877	17	2	67	63	78	51	57	2	0
57	Weller, Ovington Eugene	Maryland	Sept. 12, 1877	15	7	55	55	61	74	151	2	0
23	White, Harry Kidder	Dakota	Sept. 19, 1877	17	6	16	32	21	30	32	2	0
74	Wilkes, Gilbert	Utah	Sept. 12, 1877	14	0	74	77	46	53	158	2	0

CADET MIDSHIPMEN.

Third class, 85 members—Continued.

Order of annual merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit in—				Number of demerits.	Sea-service in practice-ships.	
				Years.	Months.	Mathematics.	English and history.	French.	Drawing.		Months.	Days.
77	Will, James Frederick	Iowa	Sept. 11, 1876	17	3	60	53	39	30	50	0	0
44	Williamson, Samuel Hill	North Carolina	Sept. 11, 1876	17	10	28	61	36	50	243	2	0
27	Wilson, Henry Braid	New Jersey	Sept. 11, 1876	15	7	14	46	34	44	270	2	0
6	Woodward, Joseph Janvier	At large	June 21, 1877	16	9	9	9	16	18	45	2	0
33	Wright, Silas Haynes	Michigan	June 28, 1876	17	10	20	66	33	28	119	2	0

§ Turned back from the second class.

‡ Reinstated.

CADET-MIDSHIPMEN.

Fourth class—76 members.

Name.	State.	Date of admission.	Age at date of admission.	
			Yrs.	Mos.
Anderson, Edwin Alexander	North Carolina	June 21, 1878	17	11
Arnold, John Thompson	Wyoming Territory	Sept. 27, 1877	17	10
Ashby, Stephen	Kentucky	June 21, 1878	16	8
Barnard, John Hall	New York	Sept. 23, 1878	17	2
Belford, Samuel Elmore	Pennsylvania	Sept. 23, 1878	17	5
Bell, Everett Nelson	Tennessee	Aug. 23, 1877	17	11
Bennett, Louis Slocum	New Jersey	Sept. 11, 1877	15	9
Blake, Robert Bunch	North Carolina	Sept. 11, 1877	16	7
Blandin, John Joseph	Alabama	June 21, 1878	15	10
Carpenter, James Franklin	Indiana	Sept. 12, 1878	15	7
Conway, John Joseph	New York	Sept. 11, 1877	17	10
Dalrymple, Elton Wesley	Iowa	June 21, 1878	16	7
Dent, Sidney Hope	At large	Sept. 11, 1876	15	7
Dovale, Arthur	New York	Sept. 23, 1878	17	10
Doyle, James Gregory	Pennsylvania	June 21, 1877	17	1
Dudley, Charles Jackson	Georgia	Sept. 11, 1877	17	0
Duncan, William Butler	New York	Nov. 1, 1878	16	6
Eames, Harold Hayden	Maine	June 21, 1878	14	6
Field, Wiley Roy Mason	Virginia	June 21, 1878	15	8
Fletcher, William Bartlett	Vermont	Sept. 11, 1877	15	8
Fowler, Hammond	Virginia	Sept. 23, 1878	16	7
Franklin, Thomas Baber	Tennessee	Sept. 15, 1875	17	11
Gignilliat, Thomas Heywood	Georgia	Sept. 23, 1878	15	7
Grambs, William Jacob	Pennsylvania	Sept. 11, 1877	15	5
Gray, Willie Theodore	North Carolina	May 8, 1878	18	0
Gwyn, Lawrence Sangston	Mississippi	June 21, 1878	16	11
Hayden, Thomas Warren	Massachusetts	Sept. 11, 1877	16	8
Hepp, Charles Frederick	Missouri	June 21, 1878	17	2
Hoke, William Peyton	Kentucky	Sept. 11, 1877	16	4
Horst, Henry August	Alabama	June 21, 1878	17	5
Howard, William Lauriston	Connecticut	Sept. 11, 1877	17	8
Hubbard, Nathaniel Mead	At large	Sept. 11, 1877	17	6
Jayne, Joseph Lee	Mississippi	June 21, 1878	15	1
Johnston, Marbury	Georgia	Sept. 23, 1878	17	9
Kenkel, Herman Henry	Minnesota	June 21, 1878	17	5
Kennett, Percy	Montana Territory	Sept. 12, 1877	17	0
Kent, George Edward	New York	June 21, 1877	16	10
Key, Albert Lenoir	Tennessee	June 21, 1877	16	11
Lamkin, John Alcus	Mississippi	June 21, 1877	17	5
Legarè, Alexander Brown	South Carolina	Mar. 20, 1878	18	0
Lodeman, Frank Felix Emile	Michigan	June 21, 1878	14	4
Martin, Clarence	Louisiana	June 21, 1878	16	3
McGiffin, Philo Norton	Pennsylvania	Sept. 11, 1877	16	9
McNutt, Finley Alexander	Indiana	Sept. 11, 1877	16	9
McWhorter, Jacob Gray	Georgia	Sept. 12, 1877	16	2
Mitchell, Sidney Zollicoffer	Alabama	Sept. 23, 1878	16	6
Miner, John Rice	Ohio	June 21, 1876	15	10
Morris, John Knox	Indiana	Sept. 23, 1878	17	5
Morris, Walter Ellis	Pennsylvania	June 20, 1877	16	6
Nixon, Lewis	Virginia	June 21, 1878	17	2

CADET-MIDSHIPMEN.

Fourth class—76 *members*—Continued.

Name.	State.	Date of admission.	Age at date of admission.	
			Yrs.	Mos.
Norton, Oliver Dwight	Ohio	June 21, 1877	17	11
Paine, Walter Taylor	Ohio	Sept. 11, 1877	14	11
Patterson, Samuel Achmuty Wainwright	At large	June 21, 1876	16	6
Philbin, Patrick Henry	Maryland	June 21, 1878	17	8
Phythian, Charles Taylor	Kentucky	June 19, 1877	16	8
Poyer, John Martin	At large	June 21, 1877	15	9
Prince, Thomas Clayton	Ohio	June 21, 1878	17	9
Rankin, Harry	Kansas	June 21, 1878	15	4
Reynolds, Charles Roberts	Arizona Territory	June 21, 1878	15	6
Ricketts, William Wallace	Virginia	Sept. 23, 1878	17	10
Salisbury, Smith	New York	Sept. 23, 1878	16	8
Savage, Ledru Rollin	Illinois	Sept. 23, 1878	17	2
Semple, Lorenzo	Alabama	Sept. 11, 1877	16	0
Schrader, George Morrison Von	Missouri	Sept. 23, 1878	16	5
Slack, William Yarnall	Missouri	June 19, 1877	16	11
Smyth, James Wilson	New York	June 19, 1877	16	5
Smith, Thomas Buchanan	Alabama	June 21, 1878	17	8
Solomon, Edward Everett	Georgia	Sept. 17, 1878	18	0
Stahle, Frederick Henry	California	Sept. 11, 1877	15	4
Sutphen, Edson Webster	Nebraska	June 21, 1878	17	9
Taylor, John	Kentucky	Jan. 15, 1876	17	11
Weeks, Edwin Babbitt	Oregon	Sept. 23, 1878	15	3
Whittelsey, William Bailey	New York	June 21, 1878	17	11
Wickes, Joseph Lee	Pennsylvania	Sept. 11, 1877	14	9
Wood, Spencer Shepard	New York	June 21, 1878	16	10
Woods, Robert Harris	Virginia	Sept. 23, 1878	17	10

Graduating class of 1878—14 *members.*

Order of general merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit in—							Number of demerits.	Sea-service in practice-ships.	
				Years.	Months.	Naval construction.	Steam-engineering.	Light and heat.	Physical measurements.	Mechanics.	Law.	Spanish.		Months.	Days.
*1	**Hollis, Ira Nelson**	Kentucky	Oct. 1, 1874	18	6	2	1	3	1	2	2	4	80	4	27
*2	**Schell, Franklin Jacob**	Pennsylvania	Oct. 1, 1874	17	1	2	3	1	3	2	1	2	28	4	27
*3	**Spangler, Henry Wilson**	Pennsylvania	Oct. 1, 1874	16	9	1	2	2	2	1	3	6	107	4	27
4	Bull, Goold Hoyt	Pennsylvania	Oct. 1, 1874	18	4	8	6	4	7	4	6	5	125	4	27
5	Griffin, Robert Stanislaus	Virginia	Oct. 1, 1874	17	0	6	5	6	12	4	5	1	56	4	27
6	McElroy, George Wightman	Michigan	Oct. 1, 1874	16	6	5	8	10	5	6	10	11	147	4	27
7	Cooley, Mortimer Elwyn	New York	Oct. 1, 1874	19	6	1	4	11	10	13	8	9	66	4	27
8	Bartlett, Frank William	Michigan	Oct. 1, 1874	18	1	10	7	14	6	14	8	8	119	4	27
9	Bieg, Frederick Charles	Missouri	Oct. 1, 1874	18	6	7	8	9	7	8	4	3	76	4	27
10	Gage, Howard	Michigan	Oct. 1, 1874	18	1	14	13	7	14	10	10	10	117	4	27
11	Wilmer, Joseph Ringgold	Maryland	Oct. 1, 1874	20	10	12	14	8	13	7	7	6	99	4	27
12	Gow, John Loudon	Indiana	Oct. 1, 1874	18	4	11	12	12	4	11	12	13	73	4	27
13	Wight, Charles Leslie	Massachusetts	Oct. 1, 1874	21	1	13	8	5	11	9	13	12	130	4	27
14	Burd, George Eli	Massachusetts	Oct. 1, 1874	17	5	8	11	12	9	11	14	10	97	4	27

CADET-ENGINEERS.

First class—23 members.

Order of annual merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit in—							Number of demerits.	Sea-service in practice-ships.	
				Years.	Months.	Steam-engineering.	Astronomy.	Electricity.	Mechanics and applied mathematics.	Composition.	French.	Spanish.		Months.	Days.
9	Acker, Edward O'Connor	Pennsylvania	Sept. 15, 1875	17	4	13	5	4	10	5	15	11	40	5	20
10	Aman, John Wesley	Massachusetts	Sept. 15, 1875	19	0	6	14	13	17	4	7	10	161	5	20
21	Baker, John Howard	Rhode Island	Sept. 15, 1875	18	0	15	22	21	20	22	19	16	181	5	20
15	Bennett, Frank Marion	Michigan	Oct. 1, 1874	17	5	17	10	17	12	13	16	17	154	5	20
18	Bevington, Martin	Ohio	Sept. 15, 1875	17	10	19	20	18	15	12	22	20	84	5	20
*3	**Bowles, Francis Tiffany**	Massachusetts	Sept. 15, 1875	16	11	1	2	4	3	10	5	4	89	5	20
19	Bowers, Frederic Clay	New Jersey	Sept. 15, 1875	17	7	22	13	14	15	16	9	7	166	5	20
4	Bryan, Benjamin Chambers	New Jersey	Sept. 15, 1875	17	1	11	4	7	4	11	6	6	54	5	20
5	Carr, Clarence Alfred	Pennsylvania	Sept. 15, 1875	19	1	8	5	3	7	1	4	5	68	5	20
22	Carter, Thomas Frederic	Kentucky	Oct. 1, 1873	18	3	20	22	14	22	15	20	23	64	5	20
16	Crygier, John Ulysses	New York	Oct. 1, 1874	16	6	12	17	18	18	6	10	13	139	5	20
14	Elseffer, Harry Smith	Iowa	Oct. 1, 1874	19	3	10	11	22	21	13	11	15	139	5	20
*2	**Gatewood, Richard**	Virginia	Sept. 15, 1875	15	11	5	3	2	2	2	2	3	41	2	21
8	Hunt, Andrew Murray	Indiana	Sept. 15, 1875	16	2	7	7	12	8	8	3	1	134	5	20
12	Isbester, Richard Thornton	Tennessee	Sept. 15, 1875	18	3	18	15	9	9	3	16	20	151	5	20
7	Ivers, Henry King	Missouri	Oct. 1, 1874	18	6	9	9	8	5	16	12	8	64	4	27
6	Lubbe, Charles Bethel	Pennsylvania	Sept. 15, 1875	18	3	3	8	6	6	9	8	14	97	5	20
*1	**McFarland, Walter Martin**	District of Columbia	Sept. 15, 1875	16	1	3	1	1	1	7	1	2	72	5	20
11	Norton, Harold Percival	New York	Oct. 1, 1874	18	10	2	18	10	13	22	23	19	74	5	20
23	Pickrell, Joseph McCall	Virginia	Oct. 1, 1874	17	2	22	19	16	23	21	21	17	179	2	9
20	Salisbury, George Robert	Missouri	Oct. 1, 1874	19	7	20	16	18	18	18	14	12	82	5	20
17	Scribner, Edward Herschell	Massachusetts	Oct, 1, 1874	19	11	14	21	22	13	18	16	22	53	5	20
13	Talcott, Charles Gratiot	Virginia	Sept. 15, 1875	16	0	15	11	10	11	18	13	9	124	5	20

CADET-ENGINEERS.

Second class—23 members.

Order of annual merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit in—					Number of demerits.	Sea-service in practice-ships.	
				Years.	Months.	Mathematics.	Physics and chemistry.	History and composition.	French.	Mechanical drawing.		Months.	Days.
8	Allderdice, William Hillary	Pennsylvania	Sept. 14, 1876	16	9	8	6	4	11	4	244	2	18
18	Belden, Charles Emery	Ohio	Sept. 14, 1876	18	6	16	19	18	18	16	72	2	18
*3	**Durand, William Frederick**	Connecticut	Sept. 14, 1876	17	6	2	2	5	6	3	114	2	18
†	Dungan, Horace Greely	Iowa	Oct. 1, 1874	20	6							2	9
12	Hall, Harry	Pennsylvania	Sept. 14, 1876	17	9	10	14	13	8	19	72	2	18
*2	**Hasson, William Frederick Converse**	Ohio	Sept. 14, 1876	19	4	1	3	3	2	5	199	2	18
†	Hogan, Thomas Joseph	Georgia	Oct. 1, 1874	18	10							2	20
14	King, Charles Alfred	Maryland	Sept. 14, 1876	18	1	13	10	8	16	17	125	2	18
11	Kinkaid, Thomas Wright	Ohio	Sept. 14, 1876	16	6	14	4	6	10	18	50	2	18
20	Lillebridge, Frederic May	Connecticut	Sept. 14, 1876	17	9	20	20	19	19	10	241	2	18
10	Manning, Charles Edward	New York	Sept. 14, 1876	17	6	12	5	10	11	8	152	2	18
16	Mathews, Clarence Herbert	Ohio	Sept. 14, 1876	19	7	17	15	16	14	15	162	2	18
21	Miller, Clarence Alexander	Virginia	Oct. 27, 1875	18	11							2	18
4	Miner, Leo Dwight	Ohio	Sept. 14, 1876	17	7	4	7	11	15	7	71	2	18
7	Sample, Winfield Scott	Pennsylvania	Sept. 14, 1876	18	10	5	13	14	13	9	83	2	18
13	Smith, Albert Edward	Wisconsin	Sept. 14, 1876	17	8	11	15	9	17	6	169	2	18
19	Smith, William Strother	Virginia	Sept. 15, 1875	18	0	17	18	20	20	13	99	2	20
*1	**Stahl, Albert William**	New York	Sept. 14, 1876	19	4	3	1	1	3	1	190	2	18
15	Weaver, William Dixon	Pennsylvania	Sept. 14, 1876	19	1	15	9	14	9	20	298	3	18
6	Wood, Joseph Learned	Virginia	Sept. 14, 1876	20	2	7	12	2	1	14	86	2	18
5	Woods, Arthur Tamatt	Massachusetts	Sept. 14, 1876	17	7	6	8	12	5	2	129	2	18
17	Worthington, John Leeds	Maryland	Sept. 14, 1876	18	3	19	17	17	4	21	73	2	18
9	Young, Albert Osborn	New York	Sept. 14, 1876	19	2	9	11	7	7	11	95	2	18

† Reinstated.

CADET-ENGINEERS.

Third class—28 members.

Order of annual merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit in—					Sea-service in practice-ships.	
				Years.	Months.	Mathematics.	English and history.	French.	Mechanical drawing.	Number of demerits.	Months.	Days.
15	Anderson, Martin Augustus	Wis	Sept. 13, 1877	19	11	16	17	13	3	115	3	0
4	Arnold, Solon	Md	Sept. 14, 1876	22	2	8	3	3	14	92	3	0
19	Bankson, Lloyd	Penn	Sept. 13, 1877	19	9	19	21	19	9	94	3	0
22	Beach, Robert James	N. Y.	Sept. 13, 1877	19	10	23	20	17	7	250	3	0
12	Bush, Arthur Richmond	Mass	Sept. 13, 1877	17	4	10	22	14	5	154	3	0
3	Byrne, James Edwin	Mass	Sept. 14, 1876	19	5	2	10	12	2	163	3	0
26	Day, Willis Bunner	Ohio	Sept. 13, 1877	19	10	26	25	23	25	123	3	0
13	Dowst, Frank Butland	Mass	Sept. 13, 1877	18	3	16	10	4	18	97	3	0
8	Eckel, Herman	Ohio	Sept. 14, 1876	20	2	13	4	2	13	95	3	0
10	Gartley, William Henry	Penn	Sept. 13, 1877	18	1	11	7	18	11	225	3	0
1	Kaemmerling, Gustave	Ind	Sept. 13, 1877	19	3	1	8	9	10	93	3	0
†	Lang, William	N. Y.	Sept. 14, 1876	18	8	....	....	....	....	6	....	....
25	McAllister, Andrew	N. Y.	Sept. 13, 1877	19	3	27	18	24	21	156	3	0
16	McAlpine, Kennett	Va	Sept. 13, 1877	17	0	19	6	7	22	193	3	0
28	McCreary, Harry Raynor	Md	Sept. 13, 1877	17	7	25	23	25	29	125	3	0
23	Moritz, Albert	N. Y.	Sept. 13, 1877	17	2	23	28	10	19	138	3	0
6	Nichols, Arthur	N. Y.	Sept. 14, 1876	19	5	9	5	6	1	105	3	0
14	Parsons, Isaac Brown	Mich	Sept. 13, 1877	17	8	11	15	27	6	165	3	0
21	Perkins, Lyman Burnham	Conn	Sept. 1 3, 1877	18	7	15	25	20	17	94	3	0
17	Redgrave, DeWitt Clinton	Md	Sept. 13, 1877	19	2	14	24	8	14	102	3	0
11	Sampson, Bias Clay	Ill	Sept. 13, 1877	19	6	6	14	16	26	104	3	0
7	Shallenberger, Oliver Blackburn	Penn	Sept. 13, 1877	17	4	5	13	11	4	69	3	0
18	Smith, William Stuart	N. Y.	Sept. 13, 1877	19	8	18	12	27	12	100	3	0
5	Stewart, jr., Robert	Mich	Sept. 13, 1877	19	5	7	1	5	23	79	3	0
20	Webster, William Townsend	N. Y.	Sept. 13, 1877	20	1	21	15	22	8	203	3	0
24	White, William Wilmot	Penn	Sept. 13, 1877	17	11	22	27	26	28	152	3	0
9	Whitham, Jay Manuel	Ill	Sept. 13, 1877	19	0	3	9	21	16	52	3	0
2	Whittle, Llewellyn Fairfax	Va	Sept. 13, 1877	18	9	3	1	1	20	103	3	0

†Turned back from the second class.

CADET-ENGINEERS.

Fourth class—28 members.

Name.	State.	Date of admission.	Age at date of admission.		Relative standing as determined at examination for appointment.
			Years.	Months.	
Addicks, Walter Robarts	Pennsylvania	Oct. 1, 1878	17	5	24
Chambers, William Henry	Pennsylvania	Oct. 1, 1878	19	11	9
Clarke, Arthur Henry	Rhode Island	Oct. 1, 1878	18	1	12
Coley, Frederick Edward	New York	Oct. 1, 1878	16	8	5
Conant, Frank Henry	Massachusetts	Oct. 1, 1878	19	5	22
Creighton, William Henry Paul	Ohio	Oct. 1, 1878	19	2	1
Fitts, James Henry	Virginia	Oct. 1, 1878	17	7	2
Ferguson, George Robert	Connecticut	Oct. 1, 1878	19	3	10
Gatewood, Robert Woodland	Virginia	Oct. 1, 1878	16	9	4
Gladstone, Daniel Demarest	New Jersey	Sept. 13, 1877	18	1	18
Gsantner, Otto Charles	New Jersey	Oct. 1, 1878	19	0	8
Hawthorne, Harry Leroy	Kentucky	Oct. 1, 1878	19	9	7
Higgins, Robert Barnard	Maryland	Oct. 1, 1878	20	0	11
Howland, Charles Henry	Rhode Island	Oct. 1, 1878	17	5	16
Leonard, John Calvin	Ohio	Oct. 1, 1878	19	3	17
Leopold, Harry Girard	Ohio	Oct. 1, 1878	19	6	18
Miller, Peter	Kansas	Oct. 1, 1878	18	7	13
Pendleton, Joseph Henry	Pennsylvania	Oct. 1, 1878	18	3	3
Prevear, Herbert Pranker	Massachusetts	Sept. 13, 1877	19	8	25
Quinby, Isaac Henry	New York	Oct. 1, 1878	17	7	15
Rommell, Charles Edward	Pennsylvania	Oct. 1, 1878	16	2	14
Simpson, Henry Lakin	Pennsylvania	Oct. 1, 1878	17	3	19
Shock, Thomas Alexander Wharton	Maryland	Oct. 1, 1878	18	4	25
Taylor, Edward Kenyon	Massachusetts	Oct. 1, 1878	18	8	21
Theiss, Emil	Wisconsin	Oct. 1, 1878	17	11	6
Willis, Clarence Calhoun	Mississippi	Oct. 1, 1878	19	0	20
Winchell, Ward Philo	Ohio	Oct. 1, 1878	19	5	23
Youchi, Sadanori	Empire of Japan	Sept. 21, 1878	19	11	.....

SUMMARY.

November 1, 1878.

CADET-MIDSHIPMEN.

First class	41 members.	
Second class	66 members.	
Third class	85 members.	
Fourth class	76 members.	
		268

CADET-ENGINEERS.

First class	23 members.	
Second class	23 members.	
Third class	28 members.	
Fourth class	28 members.	
		102
Total		370

Students from the Empire of Japan are received for instruction under a resolution of the Senate and House of Representatives of the United States approved July 27, 1868.

RESIGNATIONS AND DEATHS.

October 1, 1877, *to November* 1, 1878.

RESIGNATIONS.

Cadet-Midshipman E. D. Bronner	Oct.	1, 1877
Cadet-Midshipman C. Pleasants	Oct.	5, 1877
Cadet-Midshipman W. B. Whittelsey	Nov.	9, 1877
Cadet-Midshipman J. S. Garland	Nov.	10, 1877
Cadet-Engineer A. W. Temple	Feb.	6, 1878
Cadet-Midshipman W. E. Best	Mar.	8, 1878
Cadet-Midshipman G. E. Harrison	April	24, 1878
Cadet-Midshipman M. Jackson	April	30, 1878
Cadet-Midshipman P. Baily	May	20, 1878
Cadet-Midshipman W. N. King, jr	May	20, 1878
Cadet-Midshipman O. H. Bellinger	May	20, 1878
Cadet-Midshipman G. A. Scott	May	25, 1878
Cadet-Midshipman A. J. Jones	June	8, 1878
Cadet-Midshipman E. P. Deal	Sept.	4, 1878

DEATHS.

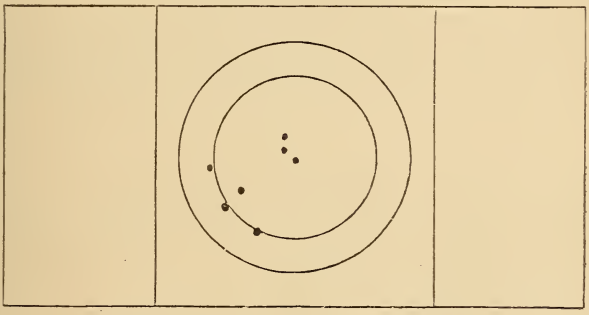
Cadet-Engineer M. D. Noell, at York, Pa	Jan.	1, 1878
Cadet-Midshipman J. B. Murray, at New York City	Aug.	11, 1878

REINSTATED.

Cadet-Midshipman John Taylor	Dec.	11, 1877
Cadet-Midshipman J. P. Porter	Dec.	13, 1877
Cadet-Midshipman Ambrose Cramer	Feb.	13, 1878
Cadet-Engineer W. Strother Smith	Feb.	26, 1878
Cadet-Midshipman J. L. Purcell	July	3, 1878
Cadet-Engineer T. J. Hogan	July	3, 1878
Cadet-Midshipman T. L. Bonfils	Aug.	14, 1878
Cadet-Midshipman A. R. Hasson	Aug.	14, 1878
Cadet-Engineer H. G. Dungan	Sept.	30, 1878

ANNUAL RIFLE-MATCH

BETWEEN MEMBERS OF THE GRADUATING CLASS, JUNE 10–20, 1878.



Target showing score of C. N. Atwater.

TERMS OF THE MATCH.

Target, that adopted by the National Rifle Association of 1875.
Distance, 400 yards.
Rifle, Remington Navy.
Position, that of a skirmisher lying down
Number of shots, 7.
Possible score, 35.

Name.	1.	2.	3.	4.	5.	6.	7.	Total.
C. N. Atwater	4	4	5	5	5	4	5	32
W. C. Canfield	5	3	5	5	5	5	4	32
J. G. Quinby	5	5	4	5	5	3	5	32
A. C. Almy	5	5	3	5	4	4	5	31
J. H. Fillmore	5	2	5	5	3	5	5	30
Total	....	....	....	....	....	....	....	157

Average score of class..... 21.6

SUMMER CRUISE, 1878.

OFFICERS AND CADET-MIDSHIPMEN

ATTACHED TO THE

UNITED STATES PRACTICE-SHIP CONSTELLATION.

Commander H. L. HOWISON, *Commanding.*
Lieutenant-Commander C. V. GRIDLEY, *Executive Officer.*
Lieutenant-Commander C. J. TRAIN, *Instructor in Navigation.*
Lieutenant W. H. EMORY, *Navigator.*
Lieutenant R. C. DERBY, *Watch-Officer.*
Master H. O. RITTENHOUSE, *Watch-Officer.*
Master G. L. DYER, *Watch-Officer.*
Master A. WARD, *Watch-Officer.*
Ensign A. C. HODGSON, *Watch-Officer.*
Surgeon, E. C. VER MEULEN.
Assistant Surgeon, W. H. RUSH.
Paymaster, A. S. KENNY.
Chaplain, ROBERT HUDSON.
Boatswain, C. E. HAWKINS.
Gunner, ROBERT SOMMERS.
Clerk to Commandant of Cadets, C. M. McLEOD.
Paymaster's Clerk, JAMES McGREGOR.

CADET-MIDSHIPMEN.

First-class (38.)

Barnard, L. H.	Garrett, L. M.	Kellogg, F. W.	Robinson, H. J.
Bell, J. A.	Garrett, L. O.	Lopez, R. F.	Schwerin, R. P.
Blish, J. B.	Gibbons, J. H.	Marsh, C. C.	Sears, W. J.
Brown, G. W.	Gibson, J.	Menefee, D. P.	Sloan, R. S.
Cahoon, J. B.	Gill, W. A.	Miner, R. H.	Snowden, T.
Chase, H. S.	Graham, W. A.	Moore J. M.	Thom, W. A.
Clements, A. B.	Harlow, C. H.	Mudd, J. A.	Tillman, E. H.
Cunningham, A. C.	Hayden, E. E.	Read, M. L.	Welsh, G. S.
Dougherty, J. A.	Hood, J.	Ripley, C. S.	Wike, H.
Drayton, P. L.	Jungen, C. W.		

Third-class (72.)

Andrews, H. B.	Cockle, R. R.	Eldredge, H.	Harrison, E. H.
Babcock, W. F.	Cohen, H. R.	Emmett, W. L.	Hill, C. H.
Ballentine, H. L.	Colwell, J. H.	Flournoy, W. F.	Hoogewerff, J. A.
Barnett, G.	Craven, M.	Ford, W. G.	Hunicke, F. H.
Blow, G. P.	Craig, B. H.	Forshew, R. P.	Karmany, L.
Buck, G. M.	Crenshaw, J. D.	Foster, E. E.	Kase, S. M.
Bunts, F. E.	Dashiell, R. B.	George, C. P.	Kimball, J. A.
Capehart, E. E.	Donnelly, M. J.	Haines, H. C.	Lauchheimer, C. H.
Carroll, E.	Doyen, C. A.	Hains, R. P.	Lindsey, J. H.
Clark, G.	Dresser, J. W.	Harmon, E. M.	Linnard, J. H.

McCrea, A.S.	Parsons, A. C.	Rodgers, G. G.	Weeks, J. W.
McJunkin, I.	Pierce, B. G.	Schock, J. L.	Weller, O. E.
Mahoney, J. E.	Porter, J. P.	Serata, T.	White, H. K.
Matthews, T. H.	Printup, D. L.	Smies, F. W.	Wilkes, G.
Moses, F. J.	Rees, J. L.	Stayton, W. H.	Williamson, S. H.
Morgan, D.	Rider, F. C.	Stewart, C. W.	Wilson, A. B.
Oliphant, A. C.	Robinson, W. M.	Sutton, F. E.	Woodward, J. J.
Parker, F.	Russell, W. W.	Uriu, S.	Wright, S. H.

The Constellation sailed from Annapolis Roads July 29, for New Bedford, Mass., arriving August 3; left New Bedford, August 7, for Oak Bluffs, arriving the same day; left Oak Bluffs, August 9, for New Bedford, arriving the same day; left New Bedford, August 13, for Newport, arriving August 14; left Newport, August 19, for Buzzard's Bay; exercised in Buzzard's Bay until September 3; then sailed for Annapolis, arriving September 9, off the bar; exercised in Chesapeake Bay until September 23. From this time until September 28 the cadets were engaged in rigging the United States sloop-of-war Dale.

UNITED STATES PRACTICE-SHIP MAYFLOWER.

Lieutenant-Commander A. D. Brown, *Commanding.*
Lieutenant J. C. Soley.
Passed Assistant Engineer C. H. Greenleaf.
Passed Assistant Engineer R. Crawford.
Assistant Surgeon J. A. Tanner, jr.

CADET-ENGINEERS.

First class (21).

Acker, E. O'C.	Bowers, F. C.	Elseffer, H. S.	Norton, H. P.
Annan, J. W.	Bryan, B. C.	Isbester, R. T.	Pickrell, J. M.
Baker, J. H.	Carr, C. A.	Hunt, A. M.	Salisbury, G. R.
Bennett, F. M.	Carter, T. F.	McFarland, W. M.	Scribner, E. H.
Bevington, M	Crygier, J. U.	Lubbe, C. B.	Talcott, C. G.
Bowles, F. T.			

Second class (1).

Weaver, W. D.

Third class (27).

Anderson, M. A.	Dowst, F. B.	Moritz, A.	Smith, W. S., (late
Arnold, S.	Eckel, H.	Nicholls, A.	fourth class.)
Beach, R. J.	Gartley, W. H.	Parsons, J. B.	Stewart, R.
Bush, A. R.	Kaemmerling, G.	Perkins, L. B.	Webster, W. T.
Bankson, L.	McAlpine, K.	Redgrave, D. W. C.	White, W. W.
Byrne, J. E.	McAllister, A.	Sampson, B. C.	Whitham, J. M.
Day, W. B.	McCreary, H. R.	Shallenberger, O. B.	Whittle, L. F.

The Mayflower left Annapolis June 24, and proceeded on her cruise, touching at Norfolk, Va.; New Castle, Wilmington, and Edgemoor, Del.; Chester, League Island navy-yard, and Philadelphia, Pa.; New York, New London, Conn.; Boston, Oak Bluffs, and New Bedford, Mass.; returning, touched at Newport Torpedo Station, Bristol, and Providence, R. I.; New London, Conn.; Cold Spring, Newburgh, West Point, and New York navy-yard, N. Y., and Washington, D. C.; sailed thence for the Naval Academy, where she arrived September 28.

Table of coefficients to be applied to the final averages in each branch in preparing the merit-rolls.

CADET-MIDSHIPMEN.

Department.	Subject.	Coefficients. First year—fourth class.	Second year—third class.	Third year—second class.	Fourth year—first class.	Graduating maximum for required studies.
Seamanship	Seamanship	.....	.....	12	15	132
	Naval Construction	.....	.....	.....	4	
	Naval Tactics	.....	.....	2	.....	
Ordnance and Gunnery	Ordnance Instructions and Infantry Tactics	.....	.....	5	.....	76
	Ordnance and Armor	.....	.....	.....	14	
Mathematics	Algebra and Geometry	9	.....	.....	.....	108
	Trigonometry, Analytical Geometry, and Descriptive Geometry	.....	18	.....	.....	
Steam-Engineering	Marine Engines	.....	.....	.....	13	52
Astronomy, Navigation, and Surveying	General Astronomy	.....	.....	6	.....	88
	Navigation and Surveying	.....	.....	.....	16	
Physics and Chemistry	Physics and Chemistry	.....	8	.....	.....	88
	Electricity	.....	.....	6	.....	
	Light and Heat	.....	.....	.....	8	
Mechanics and Applied Mathematics	Mechanics and Applied Mathematics	.....	.....	14	.....	56
	Naval Architecture	.....	.....	.....	*12	
English Studies, History, and Law	English and History	6	.....	.....	.....	80
	History and Rhetoric	.....	6	.....	.....	
	Composition	.....	.....	5	.....	
	Public Law	.....	.....	.....	3	
Modern Languages	French	2	4	4	.....	64
	Spanish	.....	.....	3	3	
Drawing	Line-Drawing and Topography	2	.....	.....	.....	16
	Sketching	.....	2	.....	.....	
Maximum for each year, exclusive of electives		76	152	228	304	760
Deduction for each demerit		.004	.007	.01	.03	.....

* Elective.

Table of coefficients to be applied to the final averages in each branch, &c.—Continued.

CADET-ENGINEERS.

Department.	Subject.	Coefficients.				Graduating maximum for required studies.
		First year—fourth class.	Second year—third class.	Third year—second class.	Fourth year—first class.	
Seamanship	Naval Construction	.....	.....	.....	4	16
Mathematics	Algebra and Geometry	9	.....	.....	.....	108
	Trigonometry, Analytical Geometry, and Descriptive Geometry	.....	18	.....	.....	
Steam-Engineering	Mechanical Drawing	2	2	.....	.....	236
	Fabrication of Machinery	.....	.....	19	36	
	Designing of Machinery					
	Marine Engines					
Astronomy, Navigation, and Surveying	General Astronomy	.....	.....	6	.....	24
Physics and Chemistry	Physics and Chemistry	.....	8	.....	.....	116
	Electricity	.....	.....	6	.....	
	Light and Heat	.....	.....	.....	8	
	Physical Measurements	.....	.....	.....	7	
Mechanics and Applied Mathematics	Mechanics and Applied Mathematics	.....	.....	14	.....	116
	Mechanics	.....	.....	.....	11	
	Naval Architecture	.....	.....	.....	4	
English Studies, History, and Law	English and History	6	.....	.....	.....	80
	History and Rhetoric	.....	6	.....	.....	
	Composition	.....	.....	5	.....	
	Public Law	.....	.....	.....	3	
Modern Languages	French	2	4	4	.....	64
	Spanish	.....	.....	3	3	
Maximum for each year, exclusive of electives		76	152	228	304	760
Deduction for each demerit		.004	.007	.01	.03	.....

MERIT-ROLLS FOR 1877-78.

Merit-rolls, made out yearly for each class, show the proficiency of the Cadets in each branch of study. The numbers given in the preceding table, showing the relative weight of the different branches, are used as coefficients; the final mark in each branch (on a scale of 4) being multiplied by the number assigned to that branch. The sum of the products, after making deductions for conduct, is the final mark of the Cadet for the year.

In the case of Cadets who take an elective course in any branch, the final mark in that branch is determined by adding to the final mark received in the required course one-fifth of the amount by which the final mark in the elective course exceeds 2.50.

In the graduating merit-roll, the final mark for the course is determined by the sum of the four yearly marks.

"Cadets who attain 85 per cent. of the multiple in any year shall be distinguished by a star affixed to their names on the merit-rolls."—(Regulations U. S. Naval Academy, § 150.)

Cadets whose names are marked thus (†) were found deficient, but were allowed to continue in their classes on condition of passing at a re-examination.

Those marked thus (‡) were found deficient, and turned back, to recommence the studies of their respective classes.

Those marked thus (§) were found deficient, and recommended to be dropped.

a denotes absence from examination.

Merit-roll of first class (36 members), annual examination, June, 1878, and general merit-roll for four years.

Order of general merit.	Name.	Seamanship.	Naval construction.	Gunnery.	Marine engines, boilers, &c.	Astronomy and navigation.	Heat and light.	International law.	Spanish.	Conduct.	Aggregate for fourth year.	Aggregate for third year.	Aggregate for second year.	Aggregate for first year.	General aggregate for four years.
	Maxima	48	32	56	48	64	32	12	12		304	228	152	76	760
*1	**John H. Fillmore**	43.20	29.52	50.82	43.92	57.92	29.76	10.53	9.18	1.53	273.32	207.36	143.31	71.43	695.42
*2	**Thomas S. Rodgers**	39.48	28.08	49.28	42.00	59.20	28.72	10.86	11.10	1.53	267.19	204.66	132.60	70.51	674.96
*3	**John G. Quinby**	42.00	28.40	49.28	42.96	56.96	30.56	10.26	8.88	3.24	266.06	198.97	132.80	68.70	666.53
*4	**Charles S. McClain**	41.52	27.76	51.52	42.96	59.20	28.56	10.50	10.14	2.58	269.58	199.48	124.11	61.68	654.85
*5	**James H. Glennon**	33.96	27.52	46.06	40.44	57.28	28.72	10.17	10.50	1.86	252.79	190.02	134.99	70.01	647.81
6	Harry S. Knapp	37.68	26.16	48.72	40.32	54.08	26.96	10.68	9.87	3.75	250.72	184.41	124.87	70.27	630.27
7	Frank J. Sprague	38.76	29.68	49.14	42.84	56.16	29.04	10.08	8.61	3.96	260.35	182.44	122.08	63.94	628.81
8	Roy C. Smith	37.44	26.64	46.48	38.40	53.28	24.88	9.57	8.94	1.20	244.43	182.86	123.67	62.63	613.59
9	William L. Rodgers	37.56	25.84	49.00	39.48	58.88	27.52	10.02	8.91	2.67	254.54	189.17	110.08	55.84	609.63
10	Albert N. Wood	43.32	29.28	48.44	38.28	54.40	26.96	9.81	9.03	1.59	257.93	181.55	113.45	56.21	609.14
11	Harry McL. P. Huse	34.56	25.04	47.46	38.28	51.36	26.16	10.53	10.95	2.46	241.88	180.21	121.62	59.16	602.87
12	George F. Ormsby	36.12	29.20	42.28	36.84	46.40	23.60	10.02	10.32	1.71	233.07	187.28	116.31	62.64	599.30
13	Charles N. Atwater	37.92	25.92	44.94	36.48	49.44	23.28	10.53	8.88	1.68	235.71	171.44	119.41	71.31	597.87
14	Edward Lloyd, jr	37.80	26.48	49.28	38.16	52.48	23.44	10.05	7.95	1.71	243.93	170.86	115.78	66.35	596.92
15	John H. L. Holcombe	37.68	27.84	48.86	36.72	48.00	20.00	10.50	8.19	0.63	237.16	174.77	116.34	67.16	595.43
16	Richard M. Hughes	35.40	26.00	45.08	36.96	54.24	28.72	10.41	10.38	3.42	243.77	169.46	115.21	66.94	595.38
17	Peyton B. Bibb	38.40	25.68	47.88	38.16	47.68	23.84	10.26	8.82	0.99	239.73	173.98	111.09	64.86	589.66
18	Robert K. Wright	40.68	26.80	46.90	38.76	48.16	22.56	9.36	9.30	2.49	240.03	169.19	108.02	66.40	583.64
19	Harry Kimmell	33.60	25.84	44.24	39.60	58.24	28.48	9.30	9.36	2.70	245.96	164.80	115.40	54.75	580.91
20	Spencer F. B. Biddle	39.36	24.00	44.52	36.72	51.52	23.76	10.35	8.46	2.22	236.47	164.09	103.67	64.34	568.57
21	Thomas W. Ryan	35.28	24.88	43.96	35.52	46.08	21.36	8.76	7.95	3.81	219.98	160.17	106.36	67.57	554.08
22	John E. McDonnell	36.24	24.56	46.34	37.56	51.84	24.24	9.09	9.72	2.31	237.28	160.83	105.50	49.02	552.63
23	William C. Canfield	34.92	23.60	43.82	36.12	44.32	21.92	8.70	9.09	1.80	220.69	159.49	103.40	67.14	550.72
24	George H. Stafford	36.72	24.48	47.60	37.44	45.92	22.08	9.96	8.82	1.47	231.55	161.19	100.26	57.65	550.65
25	William P. White	37.20	22.88	44.38	34.56	47.52	23.52	8.25	8.58	3.84	223.05	163.08	107.11	57.41	550.65
26	George R. Clark	38.16	27.20	43.12	37.44	48.00	25.44	9.84	8.37	3.33	234.24	153.15	98.93	63.71	550.03
27	George Sparhawk	37.08	24.40	44.94	34.80	48.80	20.72	8.94	8.01	3.15	224.54	155.82	104.12	57.05	541.53
28	John E. Craven	35.76	24.08	43.96	35.52	51.68	22.56	8.25	8.07	3.21	226.67	157.57	104.31	52.78	541.33

29	John H. Shipley	36.60	24.80	42.28	36.00	46.40	22.88	8.52	8.19	2.61	223.06	154.03	106.54	53.88	537.51
30	Allen G. Rogers	36.60	26.56	46.62	35.16	49.44	23.36	9.27	8.28	3.69	231.60	154.33	98.23	48.30	532.46
31	John J. Knapp	32.04	23.44	41.16	33.72	51.20	21.04	9.60	7.89	2.61	217.68	150.56	105.61	56.52	530.37
32	Wilson L. Todd	36.72	21.76	39.76	35.32	44.80	22.88	9.12	8.07	4.02	214.61	152.56	103.63	54.99	526.79
33	Horatio H. Hooke	36.24	24.08	45.22	34.08	43.68	21.04	9.12	8.37	3.57	218.26	146.40	102.80	55.94	523.40
34	James H. Hetherington	32.76	24.32	41.72	33.84	45.60	20.96	8.04	8.16	3.66	211.74	153.51	99.54	57.53	522.22
35	Bane C. Dent	36.12	25.60	39.76	37.32	45.76	22.80	8.40	8.37	3.84	218.29	149.99	100.23	52.18	520.69
36	Augustus C. Almy	31.44	22.56	38.36	33.96	42.72	20.08	8.22	7.95	3.12	202.17	153.38	105.95	53.23	514.73

Merit-roll of second class (42 members), annual examination, June, 1878.

Order of annual merit.	Name.	Seamanship.	Naval tactics.	Ordnance instructions.	Infantry tactics.	Astronomy.	Electricity.	Calculus and mechanics.	English composition.	French.	Spanish.	Conduct.	Aggregate.
	Maxima	48	8	12	8	24	24	56	20	16	12	.....	228
*1	**R. H. Miner**	40.92	7.42	10.35	7.20	21.54	21.48	54.60	16.95	14.28	10.74	0.77	204.71
*2	**E. E. Hayden**	38.16	7.50	9.96	6.04	20.82	20.82	54.04	18.90	14.32	11.49	1.05	201.00
*3	**A. B. Clements**	36.72	7.54	9.42	7.02	21.30	22.32	57.26	17.90	12.44	9.54	1.52	199.94
*4	**J. Hood**	39.60	7.54	9.75	6.14	21.30	21.84	56.56	16.45	12.68	9.69	2.14	199.41
5	H. S. Chase	37.44	7.04	9.75	6.82	20.40	21.72	48.86	15.55	13.20	10.47	2.81	188.44
6	J. McC. Moore	41.76	7.60	10.14	6.64	19.74	19.74	40.74	18.70	13.40	9.57	2.33	185.70
7	L. M. Garrett	38.76	7.60	9.84	6.58	18.60	21.00	43.54	15.05	14.64	10.95	1.12	185.44
8	J. B. Blish	37.20	7.72	9.21	6.50	18.24	22.38	48.44	14.20	13.44	9.60	1.60	185.33
9	C. C. Marsh	42.48	7.68	10.14	7.10	19.80	18.42	42.28	14.20	13.52	10.20	2.21	183.61
10	H. Wike	33.12	6.62	8.13	6.10	19.56	17.22	53.90	15.20	11.92	8.10	2.14	177.73
11	C. W. Jungen	37.92	7.14	9.99	6.84	17.58	16.86	45.64	14.60	12.60	9.51	1.42	177.26
12	R. S. Sloan	41.04	6.92	10.20	7.04	18.18	17.64	41.86	14.45	11.08	8.58	1.66	175.33
13	C. H. Harlow	41.52	7.08	9.87	6.94	17.64	16.56	38.64	14.40	12.72	9.66	2.37	172.66
14	R. P. Schwerin	39.48	6.70	9.90	6.94	17.58	18.00	38.22	13.80	11.64	9.54	1.33	170.47
15	C. S. Ripley	36.48	6.94	9.27	6.20	16.44	16.92	39.90	17.40	12.12	8.46	1.69	168.44
16	D. P. Menefee	38.28	7.26	9.42	6.10	17.76	16.14	37.10	14.10	12.72	10.20	1.35	167.73
17	L. O. Garrett	41.16	7.78	8.46	6.46	17.04	17.34	37.10	13.35	11.36	9.48	2.03	167.50
18	W. A. Gill	35.88	7.26	8.22	5.78	18.36	18.42	39.34	15.05	12.04	9.18	2.37	167.16
19	J. B. Cahoon	38.76	7.38	9.66	6.36	16.74	16.74	37.38	14.80	10.96	8.55	1.31	166.02
20	W. J. Sears	33.36	6.82	8.79	6.30	16.44	16.32	39.62	15.25	12.60	8.88	1.69	162.69
21	T. Snowden	35.40	6.48	9.75	7.18	16.50	15.36	36.40	14.85	11.92	9.24	0.86	162.22
22	J. Gibson	34.80	7.26	8.73	6.38	18.24	16.14	38.64	13.20	10.56	8.46	1.10	161.31
23	A. C. Cunningham	36.84	7.46	9.54	7.26	16.02	15.24	35.70	14.30	10.84	8.52	0.61	161.11
24	E. H. Tillman	34.92	6.34	8.82	5.86	16.14	18.24	38.92	13.80	10.40	8.01	2.12	159.33
25	J. H. Gibbons	33.96	6.72	9.21	6.08	15.90	15.36	35.98	18.00	11.28	9.24	2.51	159.22
26	R. L. Drayton	34.20	6.74	8.82	5.56	16.02	15.84	37.24	14.60	13.96	8.34	2.48	158.84
27	R. F. Lopez	33.60	6.60	8.25	5.70	16.80	15.60	38.22	14.30	11.80	8.64	1.49	158.02
28	F. W. Kellogg	33.00	6.92	9.21	5.92	16.92	15.48	37.38	14.80	11.04	8.52	1.51	157.68
29	W. A. Thom	33.84	6.66	8.82	6.32	15.78	16.56	35.98	13.80	12.00	8.46	1.09	157.13

30	G. W. Brown	34.44	6.92	9.09	5.88	16.44	16.32	36.26	13.10	11.36	8.55	1.73	156.63
31	H. J. Robinson	33.00	6.60	8.25	5.72	16.38	15.00	36.54	14.25	12.28	10.23	2.43	155.82
32	J. A. Dougherty	33.12	7.00	8.37	6.02	15.24	15.78	37.38	14.05	10.52	8.64	0.99	155.13
33	J. A. Mudd	35.64	6.68	9.57	5.96	15.66	15.24	35.70	14.55	10.80	7.80	2.52	155.08
34	J. A. Bell	32.04	7.18	8.76	5.70	15.48	16.86	37.10	12.70	10.56	8.04	1.85	152.57
35	G. S. Welsh	31.80	6.14	8.85	6.08	15.84	15.42	35.98	13.90	10.88	8.19	2.50	150.58
+	M. C. Gorgas	34.08	6.74	7.77	6.10	15.06	11.58	36.40	14.95	13.32	8.79	2.59	152.20
†	M. L. Read	33.60	6.32	8.40	6.48	15.54	14.40	35.28	13.75	11.44	8.37	1.57	152.01
†	L. H. Barnard	34.80	6.98	8.58	5.98	15.36	14.40	35.42	13.20	11.60	8.13	2.52	151.93
+	W. W. Buchanan	35.52	6.86	9.00	6.50	14.58	15.00	29.68	13.25	10.68	8.16	1.05	148.18
†	R. O. Bitler	32.40	6.62	7.83	5.72	15.06	13.44	36.12	13.55	11.12	8.28	2.25	147.89
†	W. A. Graham	32.52	6.12	8.73	5.86	14.28	12.18	35.00	14.45	10.72	7.95	2.26	145.55
†	H. L. Sturdivant	36.48	5.56	*a*	5.24	16.02	*a*	36.54	12.45	10.20	*a*	4.25	----------

CADET-MIDSHIPMEN.

Merit-roll of third class (69 members), annual examination, June, 1878.

Order of annual merit.	Name.	Mathematics.	Physics and chemistry.	History and rhetoric.	French.	Drawing.	Aggregate.
	Maxima	**72**	**32**	**24**	**16**	**8**	**152**
*1	**P. R. Alger**	74.16	27.84	21.36	14.24	6.72	142.93
*2	**H. G. Dresel**	66.24	29.20	21.36	14.60	7.76	137.84
*3	**L. S. Norton**	66.78	26.48	20.52	12.00	7.34	131.80
*4	**J. B. Bernadou**	63.18	25.28	20.22	14.12	7.78	129.40
5	W. H. Wolfersberger	63.54	24.80	20.22	12.24	7.20	127.34
6	A. A. Ackerman	60.30	28.00	19.26	11.92	7.14	125.98
7	P. W. Hourigan	61.02	24.56	21.84	12.24	6.90	124.68
8	H. Phelps	61.20	24.16	18.12	12.88	6.14	121.16
9	E. Wilkinson	56.16	27.36	18.48	13.36	6.94	120.77
10	G. E. West	60.48	24.96	17.16	12.52	5.86	120.25
11	A. R. Howze	60.30	22.32	16.80	14.16	6.50	119.48
12	P. D. Haskell	57.24	24.48	18.72	12.96	6.16	119.03
13	G. L. Dillman	59.94	22.80	17.04	12.60	7.30	118.71
14	J. B. Murray	57.78	23.76	18.12	13.84	6.20	118.36
15	S. Morgan	56.70	24.08	18.48	11.40	6.68	116.84
16	A. P. Niblack	52.38	24.32	20.76	12.32	6.90	116.27
17	W. C. P. Muir	55.44	21.84	18.84	13.36	6.42	114.92
18	T. A. Parke	54.36	22.32	18.36	13.56	5.72	113.32
19	J. S. Watters	52.56	22.24	18.84	12.52	7.34	112.21
20	J. H. Rohrbacker	51.12	23.44	20.58	12.52	5.14	112.09
21	J. M. Dickson	53.10	21.68	20.52	11.80	5.26	111.90
22	G. R. French	55.80	22.40	18.36	10.52	5.98	111.72
23	J. Beale	52.38	24.16	19.20	12.00	5.30	111.37
24	W. H. Emerson	50.94	24.88	17.10	11.84	7.20	111.01
25	J. C. Drake	56.70	21.60	16.62	10.48	6.38	110.66
26	L. Duncan	54.90	22.72	16.98	10.28	6.80	110.53
27	L. S. Van Duzer	50.22	24.96	18.54	10.04	7.30	110.13
28	W. E. Safford	45.90	25.68	17.82	13.68	7.36	109.68
29	F. R. Wall	51.66	21.60	18.72	12.40	5.98	109.42
30	A. N. Mayer	51.30	23.84	18.00	11.24	6.08	109.12
31	F. W. Bowdon	48.42	21.44	20.76	12.36	5.38	107.62
32	W. J. Maxwell	52.20	21.20	17.46	11.72	5.82	107.49
33	F. R. Brainard	52.02	21.68	16.14	10.96	7.28	107.20
34	C. Cabaniss	47.34	21.44	19.38	13.32	5.64	106.96
35	M. K. Eyre	49.86	21.84	17.46	13.12	6.26	106.78
36	R. H. Scott	51.12	21.36	16.86	11.36	6.48	106.22
37	W. S. Sims	51.84	20.80	15.96	10.88	7.72	105.77
38	H. L. Fillebrown	50.40	20.56	16.86	11.12	7.30	105.42
39	F. J. Haeseler	50.58	20.88	16.68	10.96	7.36	105.23
40	E. Simpson, jr	48.78	21.28	16.98	11.12	6.96	104.43
41	E. F. Lieper	46.62	22.16	16.74	11.56	7.66	104.24
42	F. A. Huntoon	50.40	20.88	16.44	11.16	6.38	103.66
43	A. Cramer	50.76	20.00	16.08	10.64	7.20	103.60
44	L. J. Clark	49.68	21.76	16.62	10.52	6.12	103.20
45	T. Worthington	47.88	20.00	16.32	12.24	5.90	101.18
46	F. Swift	46.98	21.52	16.68	10.28	5.66	99.76
47	T. G. Dewey	45.90	20.00	16.56	11.32	7.04	99.27
48	W. G. Richardson	45.54	20.96	16.98	11.88	5.44	99.18
49	H. B. Ashmore	46.80	20.96	16.20	11.40	5.58	99.13
50	O. H. P. Belmont	44.10	21.60	15.96	13.40	5.80	98.98
51	E. W. Nash	46.44	20.24	16.14	10.00	5.18	96.32
52	J. F. Luby	45.72	20.08	16.14	10.48	5.26	96.03
	H. C. Poundstone (not examined)						
†	W. Truxton	51.84	21.68	19.08	9.68	7.68	108.60
†	H. M. Finley	45.54	22.16	17.34	13.00	5.68	101.81
†	J. S. Brown	47.52	19.92	16.08	10.88	5.30	97.85
†	E. Brinley	46.26	19.28	16.26	10.16	5.48	96.76
†	J. Gray	44.10	22.24	15.90	10.28	5.78	96.65
†	H. Rodman	44.46	20.80	15.60	11.00	5.26	95.53
†	H. H. Bullitt	46.08	17.84	16.20	10.28	5.42	95.12
†	L. Levisee	41.58	18.96	16.08	11.92	6.40	93.80
‡	C. M. Perkins	41.58	18.00	16.14	11.20	6.48	91.76
‡	C. H. Hill	43.38	20.64	15.66	10.92	5.00	91.25
†	P. B. Cooke	43.56	16.56	15.72	10.64	5.48	90.28
†	W. A. Gresham	41.94	15.68	15.60	10.56	7.24	90.21
‡	Z. B. Vance	42.66	17.68	15.66	10.20	5.28	89.76
†	J. B. Bailey	41.58	17.04	16.20	10.72	5.22	89.32
†	E. B. Webster	35.82	13.28	13.86	10.00	5.40	76.21
‡	G. E. Perry	26.28	9.60	13.62	8.76	5.06	60.16

CADET MIDSHIPMEN.

Merit-roll of fourth class (85 members), annual examination, June, 1878.

Order of annual merit.	Name.	Mathematics.	English and history.	French.	Drawing.	Conduct.	Aggregate.
	Maxima	36	24	8	8		76
*1	**John L. Schock**	37.89	20.58	6.44	7.34	0.22	72.03
*2	**John L. Rees**	35.10	20.82	6.12	7.52	0.29	69.27
*3	**Joseph H. Linnard**	33.39	19.68	5.80	6.70	0.68	64.89
4	John A. Hoogewerff	32.22	19.14	5.96	6.58	0.27	63.63
5	Tasuker Serata	34.11	17.82	5.64	5.84	0.11	63.30
6	Joseph J. Woodward	30.78	19.38	6.20	6.78	0.18	62.96
7	Frederick C. Rider	31.59	18.84	5.64	7.02	0.18	62.91
8	Henry C. Haines	31.32	18.54	5.98	7.38	0.66	62.56
9	Eugene Carroll	31.59	18.84	6.00	6.42	0.52	62.33
10	Honston Eldredge	30.33	19.14	6.38	6.62	0.46	62.01
11	Robert B. Dashiell	27.45	20.10	6.84	7.50	0.09	61.80
12	James E. Mahoney	27.72	21.00	6.54	6.74	0.37	61.63
13	Francis E. Sutton	28.71	19.98	7.10	5.56	0.34	61.01
14	Charles A. Doyen	28.98	18.54	6.44	7.28	0.64	60.60
15	Horace B. Andrews	29.25	18.42	6.48	6.50	0.19	60.46
16	Lincoln Karmany	27.09	19.50	6.20	6.60	0.20	59.19
17	Robert P. Forshew	27.72	19.50	5.96	6.02	0.21	58.99
18	Alexander S. McCrea	26.91	19.26	6.64	7.14	0.96	58.99
19	Samuel Bryan	27.81	18.66	6.22	6.72	0.51	58.90
20	Sotokichi Uriu	28.08	17.76	6.12	6.96	0.03	58.89
21	William F. Babcock	28.08	18.48	5.94	6.02	0.15	58.37
22	Felix H. Hunicke	25.92	18.00	6.84	7.70	0.19	58.27
23	Harry K. White	28.08	17.40	6.06	6.36	0.13	57.77
24	Henry L. Ballentine	27.45	19.20	6.24	5.36	0.49	57.76
25	William F. Flournoy	29.70	17.58	5.70	5.48	0.75	57.71
26	Byron G. Pierce	26.10	18.90	5.76	6.14	0.36	56.54
27	Henry B. Wilson	28.89	16.80	5.86	6.06	1.08	56.53
28	Charles H. Lauchheimer	26.10	18.18	6.88	5.64	0.44	56.36
29	Edward E. Capehart	25.74	18.66	6.28	5.66	0.09	56.25
30	Thomas H. Matthews	26.37	18.18	6.20	6.36	1.04	56.07
31	Arthur C. Parsons	27.72	16.80	5.86	6.24	0.62	56.00
32	Frederick W. Smies	26.10	16.68	5.80	7.34	0.25	55.67
33	Silas H. Wright	27.81	16.02	5.88	6.44	0.48	55.67
34	Felton Parker	26.01	16.50	7.30	6.98	1.20	55.59
35	Frank E. Bunts	26.64	17.16	5.76	6.12	0.15	55.53
36	Charles P. George	26.37	17.16	5.58	6.92	0.51	55.52
37	William H. Stayton	26.55	18.36	5.44	5.60	0.54	55.41
38	Guy G. Rodgers	27.89	17.10	5.96	5.28	0.93	55.30
39	Charles W. Stewart	26.10	17.22	5.64	6.24	0.41	54.79
40	Robert P. Hains	25.65	16.98	5.64	7.20	0.72	54.75
41	Rudolphus R. Cockle	26.10	17.64	5.94	6.18	1.12	54.74
42	William Le R. Emmett	25.83	16.98	5.40	7.26	1.16	54.31
43	William M. Robinson	25.74	17.46	5.34	6.20	0.79	53.95
44	Samuel H. Williamson	26.91	16.20	5.80	5.96	0.97	53.90
45	Max A. Orlopp	26.19	16.44	6.04	5.72	1.01	53.38
46	MacDonough Craven	25.11	16.38	5.64	7.30	1.07	53.36
47	Ben H. Craig	25.83	17.04	5.94	5.04	0.56	53.29
48	James W. Dresser	25.74	16.68	5.34	6.14	0.67	53.23
49	James H. Colwell	24.93	17.28	5.50	5.66	0.20	53.17
50	Franklin J. Moses	25.47	16.80	5.98	5.90	0.98	53.17
51	George P. Blow	25.29	16.20	5.32	6.90	0.73	52.98
52	Edward H. Harrison	24.84	16.92	5.12	6.10	0.21	52.77
53	Harry R. Cohen	23.49	16.80	5.70	6.52	0.08	52.43
54	James D. Crenshaw	24.84	15.96	5.92	5.84	0.13	52.43
55	Spencer M. Kase	23.13	16.92	5.70	6.46	0.22	51.99
56	Edward W. Foster	25.38	16.26	5.54	5.70	1.11	51.77
57	Ovington E. Weller	24.75	16.50	5.42	5.42	0.60	51.49
58	William W. Russell	23.49	17.22	7.02	4.82	1.20	51.35
59	David L. Printup	24.57	15.72	5.40	6.08	0.76	51.01
60	George Clark	24.30	15.66	5.32	6.04	0.38	50.94
61	John A. Kimball	23.58	16.08	5.44	6.18	0.44	50.84
62	George Barnett	23.22	16.98	5.16	5.58	0.17	50.77
63	John H. Lindsey	24.30	16.14	5.50	5.60	0.95	50.59
64	Eugene M. Harmon	22.86	17.40	5.46	5.72	0.95	50.49
65	Ira McJunkin	22.50	16.74	5.30	5.82	0.08	50.28
66	Michael J. Donnelly	22.95	16.44	5.42	5.74	0.65	49.90
67	John W. Weeks	22.95	16.14	5.02	5.94	0.23	49.82
68	William G. Ford	24.57	15.06	5.20	5.68	0.70	49.81
69	Guy M. Buck	22.68	15.36	5.32	5.18	0.19	48.35
70	Daniel Morgan	22.68	15.24	5.06	5.10	0.81	47.27

CADET-MIDSHIPMEN.

Merit-roll of fourth class (85 *members*), *annual examination, June,* 1878—Continued.

Order of annual merit.	Name.	Mathematics.	English and history.	French.	Drawing.	Conduct.	Aggregate.
	Maxima	**36**	**24**	**8**	**8**		**76**
†	James F. Will	23.85	16.56	5.76	6.36	0.20	52.33
†	John Pryor Porter	22.68	16.56	5.74	5.34	0.45	49.87
†	Abbott S. Cooke	22.59	15.36	5.40	6.90	0.88	49.37
†	Rutherford W. Forrest	20.43	14.88	5.66	5.16	1.30	44.83
†	Alexander C. Oliphant	21.96	15.78	5.66	6.00	0.38	49.02
†	Gilbert Wilkes	22.50	14.88	5.68	5.86	0.63	48.29
‡	John T. Arnold	23.67	13.56	4.90	6.24	0.89	47.48
†	Llewelyn T. McKee	22.50	14.88	4.84	5.48	0.63	47.08
‡	William L. Howard	20.25	15.54	5.34	5.74	0.25	46.62
‡	Walter T. Paine	22.50	13.38	5.12	5.10	0.28	45.82
†	Sonoske Enouye	21.69	9.24	.....	5.60	0.04	36.49
‡	Edwin P. Deal	*a*	*a*	*a*	*a*	0.26	.....
†	Revere R. Gurley	24.03	16.26	*a*	5.64	1.05	.....
‡	Albert L. Key	*a*	14.66	4.56	6.00	1.00	.....
‡	John R. Miner	*a*	*a*	*a*	*a*	0.85	.....

CADET-MIDSHIPMEN.

Deficient sections of fourth class (25 *members*).

The following cadets, having been turned back at the semi-annual examination, have no relative position with the members of the fourth class:

‡ Bell, E. N.
‡ Bennett, L. S.
‡ Blake, R. B.
‡ Conway, J. J.
‡ Doyle, J. G.
‡ Dudley, C. J.
‡ Fletcher, W. B.
‡ Grambs, W. J.
‡ Hoke, W. P.
‡ Hayden, T. W.
‡ Hubbard, N. M.
‡ Kent, G. E.
‡ Kennett, Percy.
‡ Lamkin, J. A.
‡ McGiffin, P. N.
‡ McNutt, F. A.
‡ McWhorter, J. G.
‡ Morris, W. E.
‡ Norton, O. D.
‡ Poyer, J. M.
‡ Phythian, C. T.
‡ Semple, L.
‡ Slack, W. Y.
‡ Smyth, J. W.
‡ Stahle, F. H.
‡ Wickes, J. L.

Merit-roll of first-class (14 members), annual examination, June, 1878, and general merit-roll for four years.

Order of general merit.	Name.	Naval construction.	Steam-engineering.	Light and heat.	Physical measurements.	Mechanics.	Law.	Spanish.	Conduct.	Aggregate for fourth year.	Aggregate for third year.	Aggregate for second year.	Aggregate for first year.	General aggregate for four years.
	Maxima	**32**	**144**	**32**	**28**	**44**	**12**	**12**		**304**	**228**	**152**	**67.91**	**754.91**
*1	**Ira N. Hollis**	29.60	133.92	28.32	26.95	41.58	10.44	9.78	2.40	278.19	209.94	142.93	73.86	704.92
*2	**Franklin J. Schell**	29.60	128.16	30.24	25.20	41.58	10.92	10.35	0.84	275.21	207.34	138.85	70.49	691.89
*3	**Henry W. Spangler**	29.92	132.48	29.52	25.41	42.35	10.26	9.06	3.21	275.79	203.81	136.94	67.06	683.60
4	Goold H. Bull	25.60	120.60	26.56	24.22	38.06	9.54	9.57	3.75	250.40	190.30	131.15	68.62	640.47
5	Robert S. Griffin	26.80	123.48	24.24	23.10	38.06	9.60	10.50	1.68	254.10	177.79	115.13	61.50	608.52
6	George W. McElroy	27.44	114.12	23.04	24.78	36.30	9.18	7.92	4.41	238.37	180.17	119.00	65.11	602.65
7	Mortimer E. Cooley	29.12	123.84	22.96	23.94	29.04	9.39	8.58	1.98	244.89	172.54	107.58	60.30	585.31
8	Frank W. Bartlett	25.52	114.48	21.44	24.50	28.93	9.39	8.67	3.57	229.36	165.43	116.38	67.63	578.80
9	Frederic C. Bieg	26.16	114.12	23.44	24.22	30.80	9.66	10.20	2.28	236.32	167.89	111.19	60.48	575.88
10	Howard Gage	23.60	109.44	23.92	21.28	29.59	9.18	8.37	3.51	221.87	159.63	112.24	66.67	560.41
11	Joseph R. Wilmer	24.88	107.64	23.84	21.56	31.13	9.51	9.06	2.97	224.65	160.72	109.55	61.74	556.66
12	John L. Gow	25.12	110.88	22.80	25.06	29.37	9.00	8.07	2.19	228.11	157.84	110.73	59.32	556.00
13	Charles L. Wight	24.24	114.12	24.48	23.80	30.47	8.94	8.10	3.90	230.25	154.88	104.02	61.35	550.50
14	George E. Burd	25.60	111.96	22.80	24.08	29.37	8.88	8.37	2.91	228.15	160.26	102.92	48.81	540.14

CADET-ENGINEERS.

Merit-roll of second class (23 *members*), *annual examination, June*, 1878.

Order of annual merit.	Name.	Steam-engineering.	Astronomy.	Electricity.	Mechanics and applied mathematics.	Composition.	French.	Spanish.	Conduct.	Aggregate.
	Maxima	**76**	**24**	**24**	**56**	**20**	**16**	**12**		**228**
*1	**W. M. McFarland**	64.79	22.44	21.12	56.42	15.85	14.40	10.83	0.94	204.91
*2	**Richard Gatewood**	64.60	20.76	20.76	54.46	17.50	14.32	10.65	0.53	202.52
*3	**F. T. Bowles**	65.93	21.78	19.74	52.22	15.70	13.12	10.44	1.16	197.77
4	B. C. Bryan	61.37	20.16	19.32	51.38	15.65	12.44	9.93	0.70	189.55
5	C. A. Carr	62.13	19.56	20.16	43.96	17.55	13.20	10.41	0.88	186.09
6	C. B. Lubbe	64.79	18.54	19.50	44.52	15.75	12.36	8.49	1.26	182.69
7	H. K. Ivers	61.94	18.36	18.30	45.22	13.85	11.84	9.36	0.83	178.04
8	A. M. Hunt	63.08	19.08	16.68	40.18	15.80	13.80	10.89	1.74	177.77
9	E. O'C. Acker	58.90	19.56	19.74	38.22	16.20	11.36	9.03	0.52	172.49
10	J. W. Annan	63.84	17.46	16.44	36.26	16.40	12.40	9.09	2.09	169.80
11	H. P. Norton	64.98	16.08	16.74	37.24	13.55	10.56	8.19	0.96	166.38
12	R. T. Isbester	57.38	17.04	18.24	38.50	16.60	11.20	8.16	1.96	165.16
13	C. G. Talcott	58.33	17.94	16.74	38.08	13.80	11.60	9.21	1.61	164.09
14	H. S. Elseffer	61.56	17.94	15.12	35.70	15.00	11.92	8.46	1.81	163.89
15	F. M. Bennett	58.14	18.18	15.48	37.80	15.00	11.20	8.25	2.00	162.05
16	J. U. Crygier	59.28	16.38	15.36	36.12	15.95	12.00	8.52	1.81	161.80
17	E. H. Scribner	58.71	15.48	15.12	37.24	13.80	11.20	8.13	0.69	158.99
18	M. Bevington	57.00	15.66	15.36	36.82	15.55	10.72	8.16	1.09	158.18
19	F. C. Bowers	54.34	17.52	15.78	36.82	13.85	12.04	9.45	2.16	157.64
20	G. R. Salisbury	55.48	16.50	15.36	36.12	13.80	11.48	9.00	1.07	156.67
21	J. H. Baker	58.33	15.36	15.18	35.84	13.55	11.16	8.37	2.35	155.44
22	T. F. Carter	55.48	15.36	15.78	35.28	14.45	11.04	7.80	0.83	154.36
23	J. M. Pickrell	54.34	15.84	15.60	35.14	13.75	11.00	8.25	2.33	151.59

CADET-ENGINEERS.

Merit-roll of third class (21 *members*), *annual examination, June*, 1878.

Order of annual merit.	Name.	Mathematics.	Physics and chemistry.	History, composition, and rhetoric.	French.	Mechanical drawing.	Conduct.	Aggregate.
	Maxima	**72**	**32**	**24**	**16**	**8**		**152**
*1	**Albert W. Stahl**	65.70	29.52	21.84	13.84	7.64	1.33	137.21
*2	**William F. C. Hasson**	70.02	27.44	19.62	14.20	7.30	1.39	137.19
*3	**William F. Durand**	69.30	28.24	18.72	12.68	7.42	0.80	135.56
4	Leo. D. Miner	63.90	24.80	17.40	11.24	7.04	0.50	123.88
5	Arthur T. Woods	59.04	24.48	17.16	12.88	7.48	0.90	120.14
6	Joseph L. Wood	55.62	22.96	20.88	14.72	5.92	0.60	119.50
7	Winfield S. Sample	61.92	22.40	16.98	11.36	6.84	0.58	118.92
8	William H. Allderdice	55.26	25.28	19.56	11.40	7.40	1.71	117.19
9	Albert O. Young	52.38	23.12	17.88	12.20	6.70	0.66	111.62
10	Charles E. Manning	50.40	25.52	17.58	11.40	6.96	1.06	110.80
11	Thomas W. Kinkaid	48.24	25.60	18.60	11.48	5.78	0.35	109.35
12	Harry Hall	51.30	22.16	17.10	12.16	5.66	0.50	107.88
13	Albert E. Smith	51.12	22.00	17.70	10.60	7.14	1.18	107.38
14	Charles A. King	48.60	23.28	17.82	11.12	5.82	0.87	105.77
15	William D. Weaver	46.80	24.16	16.98	11.72	5.56	2.09	103.13
16	Clarence H. Mathews	46.26	22.00	16.80	11.28	5.90	1.13	101.11
17	John L. Worthington	45.00	20.32	16.02	12.92	5.38	0.51	99.13
†	Charles E. Belden	46.44	19.84	15.84	10.52	5.88	0.50	98.02
†	William S. Smith	46.26	20.00	15.60	10.08	5.94	0.69	97.19
†	Frederick M. Lillebridge	34.56	14.96	15.72	10.44	6.80	1.69	80.79
‡	William Lang	*a*	*a*	*a*	*a*	6.36	.....	.....

CADET-ENGINEERS.

Merit-roll of fourth class (29 *members*), *annual examination, June,* 1878.

Order of annual merit.	Name.	Mathematics.	Mechanical drawing.	History and composition.	French.	Conduct.	Aggregate.
	Maxima	**36**	**8**	**24**	**8**		**76**
1	Gustave Kaemmerling	31.86	6.78	17.70	6.10	0.37	62.07
2	Llewellyn F. Whittle	27.99	6.04	19.56	6.88	0.41	60.06
3	James E. Byrne	29.25	7.60	17.34	5.76	0.65	59.30
4	Solon Arnold	26.91	6.40	19.50	6.82	0.37	59.26
5	Robert Stewart, jr	27.27	5.96	19.56	6.48	0.32	58.95
6	Arthur Nichols	26.73	7.72	18.00	6.38	0.42	58.41
7	Oliver B. Shallenberger	27.90	7.36	16.98	5.82	0.28	57.78
8	Herman Eckel	25.74	6.58	18.90	6.86	0.38	57.70
9	Jay M. Whitham	27.99	6.34	17.58	5.46	0.21	57.16
10	William H. Gartley	26.37	6.74	17.82	5.52	0.90	55.55
11	Bias C. Sampson	27.63	5.74	16.92	5.64	0.42	55.51
12	Arthur R. Bush	26.64	7.18	16.20	5.70	0.62	55.10
13	Frank B. Dowst	25.11	6.16	17.34	6.58	0.39	54.80
14	Isaac B. Parsons	26.37	7.12	16.74	5.08	0.66	54.65
15	Martin A. Anderson	25.11	7.46	16.68	5.72	0.46	54.51
16	Kennett McAlpine	24.93	5.98	17.94	6.34	0.77	54.42
17	DeWitt C. Redgrave	25.47	6.40	16.02	6.14	0.41	53.62
18	William S. Smith	25.02	6.60	17.22	5.08	0.40	53.52
19	Lloyd Bankson	24.93	6.90	16.38	5.50	0.38	53.33
20	William T. Webster	24.84	6.98	16.74	5.38	0.81	53.13
21	Lyman B. Perkins	25.20	6.28	15.96	5.48	0.38	52.54
22	Robert J. Beach	24.03	7.02	16.44	5.54	1.00	52.03
23	Albert Moritz	24.03	6.06	15.18	5.92	0.55	50.64
24	William W. White	24.48	5.48	15.30	5.10	0.61	49.75
25	Harry R. McCreary	23.13	4.92	16.14	5.14	0.50	48.83
†	Andrew McAllister	22.23	6.02	16.62	5.20	0.62	49.45
†	Willis B. Day	22.32	5.80	15.96	5.32	0.49	48.91
‡	Herbert P. Prevear	21.15	5.90	16.56	5.70	0.41	48.90
‡	Daniel D. Gladstone	*a*	5.62	*a*	*a*	1.09	.....

REGULATIONS

GOVERNING

THE ADMISSION OF CANDIDATES INTO THE NAVAL ACADEMY AS CADET-MIDSHIPMEN.

NOMINATION.

I. The number of Cadet-Midshipmen allowed at the Academy is one for every Member and Delegate of the House of Representatives; one for the District of Columbia; and ten appointed at large. According to the act of Congress approved June 17, 1878, "There shall not be at any time more in said Academy appointed at large than ten." As it will take some time before the number now at the Academy can be reduced to ten, there will be no appointment at large for at least three years to come.

II. The nomination of candidates for admission from the District of Columbia and at large is made by the President. The nomination of a candidate from any Congressional district or Territory is made on the recommendation of the Member or Delegate from actual residents of his district or Territory.

III. Each year, as soon after the 5th of March as possible, Members and Delegates will be notified in writing of vacancies that may exist in their districts. If such Members or Delegates neglect to recommend candidates by the 1st of July in that year, the Secretary of the Navy is required by law to fill the vacancies existing in districts actually represented in Congress. They will be filled by appointments from the districts in which the vacancies exist.

IV. The nomination of candidates is made annually between the 5th of March and the 1st of July. Candidates who are nominated in time to enable them to reach the Academy on the 11th of June will receive permission to present themselves at that time to the Superintendent of the Naval Academy, for examination as to their qualifications for admission. Those who are nominated prior to July 1, but not in time to attend the June examination, will be examined on the 22d of September following; and should any candidate fail to report, or be found physically or mentally disqualified for admission, in June, the Member or Delegate from whose district he was nominated will be notified to recommend another candidate, who shall be examined on the 22d of September following. When any of the dates assigned for examinations fall on Sunday, the examination will take place on the following Monday.

V. A sound body and healthy constitution, good mental abilities, a natural aptitude for study and habits of application, persistent effort, an obedient and orderly disposition, and correct moral principles and deportment, are so necessary to success in pursuing the course at the Academy, that persons conscious of any deficiency in these respects are earnestly recommended not to subject themselves or their friends to the mortification and disappointment consequent upon failure, by accepting nominations and attempting to enter a service for which they are not fitted.

EXAMINATION.

VI. Each candidate for appointment as Cadet-Midshipman must present to the Academic Board satisfactory testimonials of good moral character, and must certify *on honor* to his precise age, which must be over fourteen and less than eighteen years at the time of the examination. No candidate will be examined whose age does not fall within the prescribed limits.

VII. Candidates must be physically sound, well formed, and of robust constitution; they will be required to pass a satisfactory examination before a medical board com-

posed of the surgeon of the Naval Academy, and two other medical officers to be designated by the Secretary of the Navy.

VIII. Any *one* of the following conditions will be sufficient to cause the rejection of a candidate:

Feeble constitution, inherited or acquired;

Greatly-retarded development;

Permanently-impaired general health;

Decided cachexia, diathesis, or predisposition;

All chronic diseases or results of injuries that would permanently impair efficiency, viz:

Weak or disordered intellect;

Cutaneous and communicable diseases;

Unnatural curvature of spine, torticollis, or other deformity;

Permanent inefficiency of either of the extremities or articulations from any cause;

Epilepsy or other convulsions within five years;

Impaired vision, or chronic disease of the organs of vision;

Great hardness of hearing or chronic disease of the ears;

Chronic nasal catarrh, ozæna, polypi, or great enlargement of the tonsils;

Impediment of speech to such an extent as to impair efficiency in the performance of duty;

Chronic diseases of heart or lungs, or decided indications of liability to cardiac or pulmonary affections;

Hernia or retention of testes in inguinal cavity;

Sarcocele, hydrocele, stricture, fistula, or hæmorrhoids;

Large varicose veins of lower limbs, scrotum, or cord;

Chronic ulcers.

Attention will also be paid to the stature of the candidate; and no one *manifestly* under size for his age will be received into the Academy. In case of doubt about the physical condition of the candidate, any marked deviation from the usual standard of height will add materially to the consideration for rejection. Five feet will be the minimum height for the candidate.

The board will exercise a proper discretion in the application of the above conditions to each case, rejecting no candidate who is likely to be efficient in the service, and admitting no one who is likely to prove physically inefficient. No candidate rejected by the board will be allowed a re-examination.

IX. The candidates must pass a satisfactory examination before the Academic Board in reading, writing, spelling, arithmetic, geography, and English grammar.

X. All the examinations, except in reading, will be written. Candidates who fall below the standard will receive a second and final examination in the subjects in which they fail. Deficiency in any one of the subjects at the second examination will be sufficient to insure rejection.

XI. "Candidates rejected at such examinations shall not have the privilege of another examination for admission to the same class unless recommended by the Board of Examiners."—(*Rev. Stat.*, § 1515.)

GENERAL CHARACTER OF THE QUESTIONS.

XII. ARITHMETIC.—*Notation and numeration.*—The candidate is required to express in figures any whole number, decimal, or mixed number; to write in words any given number; and to explain the Roman and Arabic systems of notation.

Denominate numbers.—The tables of money, weights, and measures in common use, including English money; addition, subtraction, multiplication, and division of denominate numbers; the relation existing between the troy and avoirdupois pound; number of cubic inches in a gallon; reduction of differences of longitude to their equivalents in time, and *vice versa*.

Fractions.—The candidate must be familiar with all the processes of common and decimal fractions, and is expected to be able to give clearly the reasons for such pro-

cesses, and to be familiar with the contracted methods of multiplication and division given in the ordinary text-books on arithmetic.

Properties of numbers.—Test of divisibility of numbers by 2, 3, 5, 8, 9, 11, 25, 125, &c.; the resolution of composite numbers into prime factors; the method of determining whether any number is prime or composite, and of finding the greatest common divisor and the least common multiple of large as well as small numbers.

Ratio and proportion.—Definitions and explanations of the nature of ratio and proportion; different methods of writing a proportion; solution of problems in simple and compound proportion.

Percentage, interest, and discount.—Examples usually given under these heads in arithmetics.

Mensuration.—The measurement of rectangular surfaces and volumes.

Evolution.—The extraction of square and cube roots.

Analysis.—Miscellaneous problems usually classed under this head, similar to those found in school arithmetics. It is essential that the candidate shall be thoroughly proficient in all branches of arithmetic; unusual excellence in this will be allowed to count in his favor in case of a slight deficiency in other subjects.

Should persons intending to present themselves as candidates acquire a knowledge of algebra, it will be found to be of material assistance in the course of study pursued at the Academy, although not required for admission.

When practicable, should the candidate so prefer, algebraic solutions of problems may be substituted for arithmetical solutions.

GEOGRAPHY.—Candidates will be questioned on the grand divisions of the land and water; the character of coast-lines; the direction and position of mountain-chains and the locality of important peaks; the position and course of rivers, their tributaries, and the bodies of water into which they empty; the position of important seas, bays, gulfs, and arms of the sea; the political divisions of the land, their position, boundaries, and capital cities; the position and direction of great peninsulas, and the situation of important and prominent capes; straits, sounds, channels, and the most important canals; great lakes, and inland seas; position and political connection of important islands and colonial possessions; locality of cities of historical political, or commercial importance (attention is specially called to the rivers and bodies of water on which cities are situated); the course of a vessel in making a voyage between well-known sea-ports.

GRAMMAR.—Candidates will be examined in the whole of English grammar as treated in the common-school text-books, embracing the following subjects: The divisions of letters and the use of capitals; the parts of speech; the classification of *nouns*, and the distinctions of person, gender, and number; under *number*, the rules for the formation of the plural, nouns irregular and defective in number, the plural of proper names; under *case*, the different uses of the three cases, the rules for inflection, the changes in ending to denote case; the difference between the definite and indefinite *article*, and the use of *a* or *an;* the classification of *adjectives;* the explanation of the different degrees of comparison; the rules for *comparing adjectives;* irregular and defective comparison; numerals and their classification; the double classification of *pronouns*, first, into substantives and adjectives, secondly, into personals, relatives, &c.; peculiarities in the use of personal pronouns, as the difference between *my* and *mine*, between *thou* and *you*, and the various uses of *it;* compound personal pronouns; the double office of relatives, and the different classes of objects to which each of them is applied; compound relative pronouns; interrogative pronouns; adjective pronouns, or pronominal adjectives, and their classification; the classification and conjugation of *verbs;* the relations between transitive and intransitive verbs; the principal parts of regular, irregular, and defective verbs; the uses and inflection of auxiliaries; the essential peculiarities in the use of voice, mood, tense, number, and person; tense-endings and personal endings; impersonal verbs; the classification, formation, and comparison of *adverbs;* conjunctive adverbs; the use of *prepositions*, *interjections*, and *conjunctions*, with the classification of the latter.

The rules for the construction and arrangement of words and sentences, given under syntax.

Parsing, according to the following model:

Noun: Class, gender, number, person, case.

Article: Definite or indefinite; qualified noun.

Adjective: Class, compared or not compared; comparison, if admitting it; degree of comparison; qualified noun.

Personal pronoun: Person, gender, number, case.

Relative pronoun: Person, gender, number, case, antecedent.

Interrogative pronoun: Gender, number, case.

Adjective pronoun (or pronominal adjective): Class; qualified word.

Verb: Class, form, principal parts, tense, mood, voice, person, number, subject.

Adverb: Class; derivation and comparison, if derived and compared; qualified word.

Preposition: Words between which the relation is shown by the preposition.

Interjection: The kind of emotion expressed.

Conjunction: Class; words or sentences connected.

The construction of the word will be required in all cases.

READING.—Candidates will be examined in reading aloud English prose in a standard work; for example, Bancroft's History of the United States.

WRITING AND SPELLING.—Candidates will be required to write a short original letter, and an exercise in dictation, and to spell twenty-four words in common use.

An exercise containing eight or more mistakes in spelling will not be considered satisfactory, and will be sufficient of itself to cause the rejection of the candidate.

ADMISSION.

XIII. Candidates who pass the physical and mental examinations will receive appointments as Cadet-Midshipmen, and become inmates of the Academy. Each cadet will be required to sign articles by which he binds himself to serve in the United States Navy eight years (including his time of probation at the Naval Academy), unless sooner discharged. The pay of a Cadet-Midshipman is $500 a year, commencing at the date of his admission.

XIV. Cadets, immediately after their admission, will supply themselves with the following articles, viz:

One parade-suit	$37 72	One hair mattress	$8 25
One undress-suit	19 45	One straw mattress	1 32
One working-suit	2 56	One hair pillow	1 10
One overcoat	23 30	One pair blankets	3 97
One rubber-coat	5 28	Two bed-spreads	2 10
One parade-cap	3 87	Six sheets	4 08
One undress-cap	1 63	Four pillow-cases	1 00
* Two pairs high shoes	11 50	* One tooth-brush	25
One pair gymnastic slippers	92	* One hair-brush	80
* Eight white shirts	9 48	* One whisk	25
* Two night-shirts	2 10	* One coarse comb	20
* Four under-shirts	2 60	* One fine comb	37
Twelve linen collars	1 92	One mug	13
* Eight pairs socks	2 00	* One cake soap	10
* Four pairs drawers	2 64	One soap-dish	13
* Six handkerchiefs	1 62	One requisition-book	30
* Eight towels	2 00	One laundry-book	30
Two pairs drill-gloves	1 28	One pass-book	30
Two pairs Lisle-thread gloves	50	One stencil and ink; 1 brush	41
* One pair suspenders	48	* One thread-and-needle case	53
One neck-tie	44	One rug	1 55
Two clothes-bags	48	One wash-basin and pitcher	1 32

Room-mates will procure for their common use—

One looking-glass (half-cost)	$0 58	One broom (half-cost)	$0 14
One water-pail (half-cost)	48	One table-cover (half-cost)	53
One slop-bucket (half-cost)	48		
Total			164 74

The articles marked *, not being required to conform to a standard pattern, may be brought by the cadet from home, but all other articles must conform to the regulations, and must, therefore, be supplied by the storekeeper.

X. Each Cadet-Midshipman must, on admission, deposit with the paymaster the sum of $50, for which he will be credited on the books of that officer, to be expended, by direction of the Superintendent, in the purchase of text-books and other authorized articles besides those enumerated in the preceding article.

All the deposits for clothing and the entrance-deposit of fifty dollars must be made before a candidate can be received into the Academy.

SUMMARY OF EXPENSES.

Deposit for clothing	$164 74
Deposit for books, &c	50 00
Total deposit required	214 74

The value of clothing brought from home is to be deducted from this amount.

Each Cadet-Midshipman, *one month after admission*, will be credited with the amount of his actual expenses in traveling from his home to the Academy.

XV. A Cadet-Midshipman who voluntarily resigns his appointment within a year of the time of his admission to the Academy will be required to refund the amount paid him for traveling expenses.

R. W. THOMPSON,
Secretary of the Navy.

EXAMINATION OF CANDIDATES FOR ADMISSION AS CADET-MIDSHIPMEN, JUNE, 1878.

ARITHMETIC.

JUNE, 1878.

1. Divide .00022406853 by .0746. Divide 224.06856 by .00746. Reduce .0028125 to a common fraction in its lowest terms. Divide 9.614 by .0000019, and $\frac{2\frac{1}{3}}{5\frac{1}{2}}$ by $\frac{1}{8}$ of .001 and multiply the sum of the quotients by .0005.

2. Simplify each of the expressions

$$\frac{2.5+1.25-2.125}{3.75+2.3-4.25}, \text{ and } \frac{1}{.01}-\frac{.0009}{.4 \text{ of } .0005+.002 \text{ of } .0125}.$$

Multiply $\left\{\frac{1}{1+\frac{1}{1+\frac{1}{2}}}+\frac{1}{1+\frac{1}{5}}-\frac{13}{30}\right\}$ by $\left\{1\frac{1}{8}-\frac{2\frac{2}{3}}{4\frac{1}{5}}\right\}$, and divide the result by $\left\{\frac{27}{64}-\frac{20}{63}\right\}$.

3. Express 5 days, 14 hours, 49 minutes, 12 seconds as a decimal of 30 days. What decimal part of a Troy pound is 4 dwts., 12 grains? Subtract 9.85 inches from .375 yards, and give the result in feet. Reduce $\frac{£19\ 16s.\ 7\frac{3}{4}d.}{£20\ 10s.\ 8\frac{3}{4}d.}$ to its lowest terms.

4. Find the interest on $750 for two years, 3 months, at 7 per cent. per annum. Find the interest on £200 10*s.* 10*d.* for 3 months, at 8 per cent. per annum. What was the premium on gold when a greenback dollar was worth only 75 cents? The silver dollar weighs 412½ grains; supposing silver to be worth $1.05 per oz. Troy, what per cent. of profit does the government make on each silver dollar coined?

5. A man buys 27 sheep for $144, and sells 12 of them at a loss of 3 per cent.; at what price per head must he sell the remainder in order to clear 2½ per cent. on the whole purchase? If 8 men can perform a piece of work in 12⅔ days, in what time will 9 men and 5 boys working together do the same work, if a boy can do ⅝ of a man's work?

6. Find the square root of 3145.685 to four decimal places, and the cube root of 991 to three decimal places. What is the value of $\sqrt{3789954} \times \sqrt{3789954}$? Write the values of the following expressions (only *one* significant figure required in each case) $\sqrt{.049}$, $\sqrt{.0009}$, $\sqrt[3]{.0000027}$.

7. How many yards of carpet 2 feet 1 inch wide will it take to carpet the floor of a room 25 feet long and 20 feet wide? What is the width of a piece of canvas which is 7 feet 3⅜ inches long, and covers 2 square yards 103¾ square inches? The carpeting of a room twice as long as broad, at $1 per square yard, costs $24.50; and the painting of the walls, at 15 cents per square yard, costs $10.50; what is the height of the room?

8. Find to seven decimal places the value of the series

$$\left\{\frac{1}{3}+\frac{1}{3}\cdot\frac{1}{(3)^3}+\frac{1}{5}\cdot\frac{1}{(3)^5}+\frac{1}{7}\frac{1}{(3)^7}+\ \&c.\right\}$$

ENGLISH BRANCHES.

JUNE 26, 1878.—*Time allowed, three hours.*

GRAMMAR.

1. Decline (or inflect) *city, which, sea, wharf.*
2. What adverb corresponds to the adjective *good? happy? true? wise? noble?*

3. Give the principal parts of *smite, rid, steal, drown, throw.*
4. Explain the use of the indicative mood, and of the tenses included under it.
5. What part of speech is *as* in each of the following sentences?
   1. Do *as* I do.
   2. *As* we have finished, we will go.
   3. Let such *as* hear, take heed.
6. Parse the words in italics in the following:

Thus ended the *reign* of terror, a *period fraught with greater* political *teaching than any* of *equal* duration *which* has existed *since* the *beginning* of the world.

SPELLING.

Peaceable,	Competition,	Besiege,	Victuals,
Height,	Comparative,	Participle,	Tongue,
Business,	Sagacity,	Jealous,	Officious,
Seizes,	Militia,	Legislate,	Jeopardy,
Vertical,	Battalion,	Vengeance,	Referred,
Coincidence,	Cemetery,	Tyrannical,	Syllable.

GEOGRAPHY.

1. Bound Kansas.
2. Where is Valparaiso? Pensacola? Aberdeen? Batavia? Lyons?
3. Where is the Gulf of Lyons? Bay of Bengal? Cattegat? Great Bear Lake? Tigris River?
4. Where are the Green Mountains? Blue Ridge? Black Forest? White Mountains? Sierra Nevada?
5. Make a *coasting* voyage from Savannah to Cayenne, naming in order the States or countries you pass and the waters you pass through.

RE-EXAMINATION.

ARITHMETIC.

JUNE, 1878.—*Time allowed, five hours.*

1. Divide 7006.652 by 12.34; .000144 by .012; and .014904 by $3\frac{6}{25}$. Find the sum of $\frac{11\frac{13}{100}-.35}{.05-\frac{1}{75}}$ and $\frac{7}{125}+6.007$, and the difference between $\frac{2}{3}(1.35-.72)$ and 5.004, and divide the sum by the difference.

2. If one mean of a proportion is $5\frac{5}{8}$ and the two extremes are $2\frac{2}{4}$ and $7\frac{1}{8}$, find the other mean. How many men would it employ for $5\frac{1}{2}$ days to cultivate a field of $2\frac{5}{8}$ acres, if each man completed 77 square yards in 9 hours, and the day consisted of 10 hours?

3. Divide 345 lbs. 9 oz. 16 dwts. 20 grs. by $13\frac{5}{7}$. Find a sum of money that shall be the same part of £14 7*s.* $9\frac{3}{4}$*d.* that 4 oz. 7 dwts. 5 grs. is of 8 oz. 10 dwts. 15 grs.

4. After deducting a charge of $8\frac{3}{4}$ per cent. on a certain sum of money and $6\frac{1}{2}$ per cent. on the remainder, the result is $1,365.10; find the original sum.

5. Find the cube root of 377.149515625, and the square root of $5017\frac{13}{36}$.

6. Divide 1 by 2, the quotient by 3, that quotient by 4, and so on, increasing the divisors by unity each time and carrying out the division to 8 decimal places, until a quotient is obtained which has no significant figure up to the eighth decimal place, then add all the quotients together.

7. If 3.1416 represents 180°, what does 1. represent? (Answer in degrees, minutes, and seconds.) Find the ratio between the rates of two locomotives, one of which travels $397\frac{5}{6}$ miles in $11\frac{2}{3}$ hours, the other $262\frac{4}{13}$ miles in $8\frac{4}{9}$ hours.

8. *A* can perform a certain piece of work in 12 hours. *A* and *B* together can do it in 5 hours, and *C* can do $\frac{3}{2}$ as much work in an hour as *B* can. *A* begins to work at 5

o'clock; at what time shall *B* and *C* join him, so that all working together they may complete the work at 12 o'clock? and if $8.40 is paid for the whole work, how should it be divided between *A*, *B*, and *C*?

ENGLISH BRANCHES.

JUNE 28, 1878.—*Time allowed, three hours.*

GRAMMAR.

1. Decline (or inflect) *gulf, sky, journey, sheep.*
2. Give the principal parts of *mean, strive, sit, set, blow.*
3. Name the adverbs corresponding to *shy, able, cruel, worthy, bad.*
4. Name the three cases, and explain the different uses of each.
5. What part of speech is *that* in each of the following sentences:
   1. *That* book belongs to me.
   2. I know *that* you want him.
   3. The people *that* I knew once.
   4. The court of England, or *that* of France.
6. Parse the following: At every step which you take, you will now remember the sacrifice you made for your country.

SPELLING.

Imperative,	Sovereign,	Carcass,	Conscience,
Sagacity,	Sincerity,	Equivalent,	Preference,
Autumn,	Receive,	Scientific,	Virtuous,
Until,	Believe,	Precedence,	Vicious,
Privileges,	Tantalize,	Division,	Resurrection,
Auxiliary,	Guile,	League,	Campaign.

GEOGRAPHY.

1. Where is Stettin? Galveston? Monrovia? Singapore? Cherbourg?
2. Describe the following rivers, telling where they rise, in what direction they flow, and into what water they empty: 1, Loire; 2, Irrawaddy; 3, Vistula; 4, Dnieper.
3. On what water is each of the following: 1, Charleston; 2, Geneva; 3, Calcutta; 4, Lisbon; 5, Hamburg.
4. Name the chief peninsulas of Europe, and tell in each case the inclosing bodies of water.
5. Where is Mount Chimborazo? Mount Hecla? the Cevennes Mountains? Blue Ridge? Pyrenees?

REGULATIONS

FOR THE

APPOINTMENT OF CADET-ENGINEERS IN THE UNITED STATES NAVY.

I. In pursuance of law, applications will be received by the Navy Department for the appointment of Cadet-Engineers.

II. The application is to be addressed to the Secretary of the Navy, and can be made by the candidate or by any person for him, and his name will be placed on the register. The registry of a name, however, gives no assurance of an appointment, and no preference will be given in the selection to priority of application.

III. The number of appointments which can be made is limited by law to twenty-five each year. The candidate must not be less than sixteen nor more than twenty years of age; he will be required to certify *on honor* to his precise age, to the Academic Board, previous to his examination, and no one will be examined who is over or under the prescribed age. His application must be accompanied by satisfactory evidence of moral character and health, with information regarding date of birth and educational advantages hitherto enjoyed. Candidates who receive permission will present themselves to the Superintendent of the Naval Academy on the 15th of September for examination as to their qualifications for admission.

IV. The course of study will comprise four years at the Naval Academy, and two additional years at sea. All cadets who finally graduate will be commissioned Assistant Engineers in the Navy as vacancies occur. The pay of a Cadet-Engineer while at the Naval Academy is $500 per annum.

V. The academic examination previous to appointment will be competitive, and will be on the following subjects, namely: Arithmetic; algebra, through equations of the first degree; plane geometry; rudimentary natural philosophy; reading; writing; spelling; English grammar; English composition, and geography. The candidate will also be required to exhibit a fair degree of proficiency in pencil-sketching, and to produce satisfactory evidence of mechanical aptitude, and an elementary knowledge of the principles governing the action of the steam-engine. Candidates who possess the greatest skill and experience in the practical knowledge of machinery, *other qualifications being equal*, shall have precedence for admission.

The other requisites and conditions are the same as those for the admission of Cadet-Midshipmen.

COMPETITIVE EXAMINATION OF CANDIDATES FOR APPOINTMENT AS CADET-ENGINEERS, SEPTEMBER, 1878.

ARITHMETIC.

Time allowed, three hours.

1. At 10h. 33m. a. m., a ship was in latitude 37° 51′ N., longitude 55° 37′ W., and at 3h. 25m. p. m. she was in latitude 38° 45′ N., longitude 55° 23′ W.; her rate in the interval being uniform, what was her latitude and longitude at noon of the same day? The results are required to the nearest second.

2. The silver dollar weighs 412½ grains, $\frac{9}{10}$ of which is pure silver. At the English mint a mixture of 11 oz. 2 dwts. of silver with 18 dwts. of alloy is coined into 66 shillings. When English silver is worth 54*d.* per oz. in gold, and the pound sterling (gold) is worth $4.86 in United States gold, what is the value in United States gold of the silver contained in the dollar? (The value of the alloy in English silver is not to be considered.)

3. How many gallons (231 cubic inches) will be contained in a tank whose dimensions are 20 feet 8 inches by 11 feet 10 inches by 8 feet 5¾ inches? If it costs $3.75 to paper the walls of a room, what will it cost to paper the walls of another room, whose breadth, height, and length are each half as much again, the paper being half as wide again, and costing twice as much per linear yard?

4. The time of oscillation of a pendulum varies as the square root of its length, and the *seconds* pendulum is 39.1393 inches long; find the length of one which oscillates 80 times in a minute (4 decimal places). Find the cube root of 4920 to 5 decimal places.

5. When it is noon by the true time, a watch is slow $6\frac{7}{11}$ minutes, and loses at the rate of 12 minutes in exactly 20½ hours of *true* time. What is the true time when the hands are together between 3 and 4 o'clock of the same day?

ALGEBRA.

Time allowed, three hours.

Simplify the expressions—

$$6\left\{\frac{x+y}{2}-\frac{x-2y}{3}\right\}-36\left[\frac{x}{18}-\left\{\frac{3x-4y}{9}-\frac{1}{3}\left(\frac{x}{4}-\frac{5x+2y}{6}\right)\right\}\right],$$

and

$$\frac{\dfrac{a^2}{a^2+b^2}}{\dfrac{a+b}{a+b}-b}+\frac{b^2}{\dfrac{a^2+b^2}{a+b}-a}$$

2. Simplify $(x^a)^{b-c}\cdot(x^b)^{c-a}\cdot(x^c)^{a-b}$. Find the simplest factors of x^3+y^3, x^2+5x+6, $6x^2+5x-6$, $x^4-3a^2x^2+a^4$, and $x^2-\left(\frac{a}{b}-\frac{b}{a}\right)x-1$.

3. Find the greatest common division of $qnp^3+3np^2q^2-2npq^3-2nq^4$, and $2mp^2q^2-4mp^4-mp^3q+3mpq^3$. Divide 1 by $1-\frac{x}{2}+\frac{x^2}{4}$ as far as the term involving x^4. Find the coefficient of x^4 in the product of

$$1-\frac{x}{2}+\frac{x^2}{4}-\frac{x^3}{8}+\frac{x^4}{16} \text{ by } 1+\frac{x}{2}+\frac{x^2}{4}+\frac{x^3}{8}+\frac{x^4}{16}.$$

4. Prove that if 16 be added to the continued product of any four consecutive odd integers, the result will be a perfect square. Solve the equation

$$\frac{x+2}{3}-\frac{38-2x}{6}+\frac{x-8}{8}-\frac{4}{9}(x-7)=2.$$

5. Solve the equations—

$$\left.\begin{aligned}\tfrac{3}{4}x-\tfrac{2}{5}y&=6\\ \tfrac{x}{2}+\tfrac{2y}{3}&=18\end{aligned}\right\} \text{ and } \frac{(x-a)^3}{(x-b)^3}=\frac{x-2a+b}{x-2b+a}.$$

GEOMETRY.

Time allowed, two hours and a half.

1. Define *right angle*, and *perpendicular, parallelogram, rhombus, rhomboid, trapezoid.* Prove that if from any point within a triangle two straight lines be drawn to the extremities of either side, their sum will be less than that of the remaining two sides of the triangle.

2. Prove that an inscribed angle is measured by one-half its intercepted arc. What is the measure of an angle formed by a chord and a tangent? What is the measure of an angle formed by two secants intersecting without the circumference? Prove the latter.

3. Prove that the line which bisects either angle of a triangle divides the opposite side into segments proportional to the adjacent sides. The hypothenuse of a right triangle is a and one of the adjacent angles is 30°, a line is drawn bisecting the angle; find the segments into which it divides the opposite side.

4. What is meant by extreme and mean ratio? Prove that if the radius of a circle be divided in extreme and mean ratio, the greater segment will be equal to one side of the regular inscribed decagon. Denoting the radius by a, find an expression for the side of the decagon.

5. Two tangents AB and AC are drawn to a circle. D is any point on the circumference *outside* of the triangle ABC. Prove that the sum of the angles ABD and ACD is constant, and show what this constant sum is. Show how the result is modified when D is taken within the triangle ABC.

NATURAL PHILOSOPHY.

Time allowed, three hours.

1. Define the terms specific gravity, density, centre of gravity. Determine the weight of a cubic yard of a homogeneous body whose specific gravity is 1.2, the weight of a cubic foot of water being 1,000 ounces.

2. How would you determine the specific gravity of a piece of cork? Find the centre of gravity of a triangle.

3. How would you find practically the centre of gravity of an irregularly shaped piece of flat boiler-iron of uniform thickness? The top of the leaning tower of Pisa overhangs its base by 12 feet. Why does it not fall?

4. Explain clearly what you understand by the weight of a body. If a body be weighed with the *same spring balance* at this place and at the equator, will its weight, as thus ascertained, be the same in both instances? Give the reasons.

5. A vessel whose sides are vertical and base horizontal contains 3 quarts of water, the depth being 10 inches; when a piece of copper whose specific gravity is 8.9 is immersed, the surface of the fluid rises to the height of 11½ inches. Find the weight of the copper, a pint of water weighing one pound.

6. Two heavy spheres whose diameters are 4 and 3 inches respectively are suspended at the opposite ends of a straight rod 7 feet 7 inches in length. Find that point on the rod at which a support must be placed in order that the system may be sustained with the rod in a horizontal position.

7. Find the reading of the centigrade thermometer which corresponds to 122° of Fahrenheit's scale. If the difference of readings of a thermometer which is graduated according to both Fahrenheit's and the centigrade scales be 40°, find the temperature by each scale.

8. Find the height to which a common pump can raise a liquid whose specific gravity is 1.7 when the barometer stands at 29 inches, the specific gravity of mercury being 13.6.

ENGLISH BRANCHES.

SEPTEMBER, 1878.—*Time allowed, three hours.*

ENGLISH GRAMMAR.

1. Decline (or inflect) *chimney, commander-in-chief, cargo, wife.*

2. What is a transitive verb? a participle? an ordinal? a personal pronoun? an impersonal verb?

3. Give the principal parts of *hold, ring, stick, lay, lie, set, sit.*

4. Compare *many, little, cleanly, elder, next,* without using adverbs.

5. How does the potential mood represent a fact? What tenses has this mood? Give the first person singular of the verb *to lay* in each of the tenses of this mood.

6. Parse the words in italics. The effect of the *explosion* had been *so violent, that* the tower *was cracked for more than forty feet above* the chamber of the mine; *but this* was *only* a *crack.*

GEOGRAPHY.

1. What countries border on the Adriatic? the Baltic?

2. Fix the position of the following islands, and state to what nation each belongs: 1. Malta; 2. Iceland; 3. Corsica; 4. St. Helena; 5. Jamaica.

3. Name in order the states of South America bordering on the sea-coast, and give the capital of each.

4. Where is Cape St. Roque? Cape Clear? Cape St. Vincent? Cape Comorin?

5. Tell the source, direction, and mouth of the Rhine, the Rhone, the Danube, and the Ganges.

SPELLING.

Deceitful,	Supremacy,	Fiend,	Fatigue,
Military,	Siege,	Supersede,	Inseparable,
Jealousy,	Scissors,	Absence,	Column,
Judgment,	Guardian,	Business,	Perceive,
Definite,	Genius,	Parallel,	Prejudice,
Auxiliary,	Courageous,	Recommend,	Stratagem.

COURSE OF INSTRUCTION.

DEPARTMENT OF SEAMANSHIP.

SEAMANSHIP.*—Description of all kinds of rope, and its practical manipulation for all purposes on shipboard; measuring for and fitting standing and running rigging; masting, sparring, and rigging ship; getting on board and stowing a vessel's outfit; organizing a ship's company; fittings of boats; management of boats under all circumstances; evolutions of vessels at sea and in harbor; repair of spars and rigging in cases of accident; duties of officers at sea and in port; rules of the road; wind and weather.

Text-book.—Luce's Seamanship, with lectures and illustrations from models.

NAVAL CONSTRUCTION.

Text-books.—Thearle's Naval Architecture and Wilson's Ship-Building, with lectures illustrated by models and drawings.

NAVAL TACTICS.*—Organization, formations, and manœuvring of a fleet, under steam or sail.

Text-books.—Manual of Naval Tactics (Ward); Steam Fleet Tactics (Parker); United States Naval Signal-Book; Manual of Signals (Myer).

PRACTICAL EXERCISES, consisting of—

SEAMANSHIP-DRILLS.*—Exercises on shipboard with sails and spars.

NAVAL TACTICS.*—Exercises in boats under oars and under sails.

SIGNALS.—Exercises in the use of signals according to Myer's Army Signal Code.

The instruction in boxing, gymnastics, swimming, and dancing is in charge of this department.

DEPARTMENT OF ORDNANCE AND GUNNERY.

PRACTICE AND THEORY OF GUNNERY.*—*Practical naval gunnery*, as laid down in the Ordnance and Gunnery Instructions for the United States Navy.

Preparation of gun-iron from crude ore, including the description and use of furnaces. Manufacture of wrought iron, steel, and bronze. Fabrication of guns of all descriptions. Manufacture of gunpowder and fuses, and of all kinds of projectiles and fireworks.

Theory of gunnery.—Motion of projectiles *in vacuo* and in the atmosphere; initial, remaining, and final velocities, and the methods of determining their values; the effects of variations of charge, windage, and weight of projectiles; deviation of projectiles; the several systems of pointing; tangent-sights and determination of their values; penetration and shock of projectiles; and recoil of guns.

Text-books.—Cooke's Naval Ordnance and Gunnery; Ordnance Instructions, United States Navy; Gunnery Instructions, United States Navy.

INFANTRY TACTICS.*—Organization and formation of squad, company, and battalion; school of the soldier; company and battalion drill, including instructions for skirmishers and the bayonet exercise.

Text-books.—United States Infantry Tactics; Wingate's Rifle Practice.

PRACTICAL EXERCISES, consisting of—

INFANTRY-DRILL.

FIELD-ARTILLERY AND BOAT-HOWITZER EXERCISE.

GREAT GUNS.—Exercises and target-practice on board the United States ship Santee.

MORTAR-PRACTICE.

FENCING.—Exercise with small-swords and broadswords.

* Cadet-Midshipmen only.

DEPARTMENT OF MATHEMATICS.

ALGEBRA.—Fundamental operations; reduction and conversion of fractional and surd quantities; involution and evolution; reduction and solution of equations of the first and second degrees; the summation of series; the nature, construction, and use of logarithms; the theory of equations.

GEOMETRY.—Plane and solid geometry; the mensuration of surfaces and volumes; the application of algebra to geometry.

TRIGONOMETRY.—Analytical investigation of trigonometric formulas, and their application to all the cases of plane and spherical trigonometry; the construction and use of trigonometric tables; the solution of trigonometric equations; trigonometric series.

ANALYTICAL GEOMETRY.—Equations of the right line, plane, and conic sections; discussion of the general equation of the second degree involving two or three variables; determination of loci; principal problems relating to the cylinder, cone, sphere, and spheroids.

DESCRIPTIVE GEOMETRY.—The graphic illustration and solution of problems in solid geometry, and the application of the method, particularly to the projections of the sphere and to the construction of maps.

Text-books.—Ray's Higher Algebra; Chauvenet's Geometry; Chauvenet's Trigonometry; Church's Descriptive Geometry; Todhunter's Conic Sections; Bowditch's Useful Tables.

ELECTIVE COURSES.

In addition to the above, Cadets of the third and fourth classes who display marked ability in mathematics are permitted to take an advanced course. The following are the elective courses for 1878–'79:

Fourth class.—Algebra, the theory of equations, and curve-tracing.

Third class.—The elements of the differential and integral calculus, with applications to trigonometry and geometry of two dimensions.

Text-books.—Todhunter's Algebra for Colleges and Schools; Todhunter's Theory of Equations; Rice and Johnson's Elements of the Differential Calculus.

DEPARTMENT OF STEAM-ENGINEERING.

MARINE ENGINES.—General theory of the steam-engine; classification and details of marine steam-engines, and of instruments and apparatus used in connection with them; the computation of the power and its cost; the duties of the engine-room watch, and of the engineer division.

FABRICATION OF MACHINERY.*—The qualities and strength of materials, and the processes of manufacture, accompanied by practical exercises with the workshop methods and appliances for the conversion of the various materials into finished machinery.

DESIGNING OF MACHINERY.*—Pure mechanism, and the designing of boilers and engines, including valve-gears.

MECHANICAL DRAWING.*—The nomenclature of design; general and conventional practices of the art; the execution of plans, elevations, and sections; isometrical projections; shades, shadows, and linear perspective.

PRACTICAL EXERCISES.—The management of marine steam-apparatus; [the use of tools and machines; hand-work of the machine-shop, pattern-shop, smithery, boiler-shop, and foundry.]*

Text-books.—Weisbach's Mechanics of Engineering, Vol. II; Northcott's Steam-Engine; Warren's Elements of Mechanical Drawing; Willis's Principles of Mechanism; Rankine's Steam-Engine and other Prime Movers; Zeuner's Valve-Motion, and Shelley's Workshop Appliances.

* Cadet-Engineers only.

DEPARTMENT OF ASTRONOMY, NAVIGATION, AND SURVEYING.

ASTRONOMY.—Descriptive and practical astronomy, including the use of instruments, especially those used for determining terrestrial latitudes and longitudes.

Text-books.—C. J. White's Astronomy; Theory of the Portable Transit and the Zenith Telescope.

NAVIGATION.*—Theory and practice of navigation, the latter including instruction in the duties of the navigator, the use of navigating instruments, and their construction, with the solution of problems and the use of tables.

Text-books.—Coffin's Navigation; Merrifield's Deviation of the Compass; Bowditch's Navigator; Howell's Marine Surveying.

SURVEYING.*—The form of the earth, with special reference to the construction of charts; explanation of geodetical surveys; the solution of problems in nautical surveying; and practical work in surveying and constructing charts.

Text-book.—Howell's Marine Surveying.

DEPARTMENT OF PHYSICS AND CHEMISTRY.

ACOUSTICS.—Theory of waves; the production and propagation of sound; the numerical evaluation of sound; modes of vibration; communication of vibrations; analysis of vibrations.

OPTICS.—The propagation, reflection, and refraction of light; lenses, vision, and optical instruments; spectrum analysis; color; the undulatory theory of light; polarization and double refraction.

ELECTRICITY AND MAGNETISM.—Magnetism; statical electricity; Voltaic electricity; electro-magnetism; electrical measurements; applications of electricity; thermo-electricity.

CHEMISTRY.—General chemistry.

METEOROLOGY AND CLIMATOLOGY.

EXPERIMENTAL LECTURES IN PHYSICS AND CHEMISTRY.

HEAT.—Theories of heat; sources of heat; conduction, radiation, and convection; specific heat; effects of heat; instruments used for the measurement of heat; thermodynamics.

PHYSICAL MEASUREMENTS.†—In this course the Cadets are permitted to elect between work in the physical laboratory and work in the chemical laboratory.

The work in the physical laboratory during the year 1877–'78 has consisted in determinations of specific and latent heat; the comparison of several methods of determining the hygrometric state of the atmosphere; the determination of specific gravities; the determination of heat conductivity; the determination of the dip, declination, and intensity of the earth's magnetism; the use of the spectroscope and of the spectrometer; the determination of the indices of refraction; experiments in tempering steel; experiments on the torsional and tensile strength of wires.

The work in the chemical laboratory during the year 1877–'78 embraced blowpipe analysis; crystallography; mineralogy; quantitative analysis.

The course in mineralogy comprised the study in the mineral cabinet of the most commonly recurring minerals, the useful ores, and the objectionable minerals which are frequently associated with them.

The course in quantitative analysis consisted of the gravimetric determination of—

Iron in ammonio-ferrous sulphate.

Copper and tin in gun-metal.

Copper, antimony, and zinc in "white brass."

Tin and lead in solder.

Lead, carbon dioxide, and insoluble residue in a white lead ground in oil.

Valuation of a coal.

The preparation and standardizing of a solution of potassia permanganate by means of iron wire, ammonio-ferrous sulphate, oxalic acid, and ammonic oxalate.

* Cadet-Midshipmen only. † Cadet-Engineers only.

The estimation of iron in an iron salt, and in hematite and magnetite ores by means of the permanganate solution.

Preparation and standardizing of a solution of potassia dichromate.

Estimation of iron in an iron salt by Penny's method.

Text-books.—Stewart's Elementary Physics; Eliot and Storer's Chemical Analysis; Jenkins's Magnetism and Electricity; Stewart's Elementary Treatise on Heat; Miller's Inorganic Chemistry; Kohlrausch's Physical Measurements; Nason and Chandler's Blowpipe Analysis; Dana's Manual of Mineralogy; Thorpe's Quantitative Chemical Analysis.

Reference-books.—Ganot's Physics; Maxwell's Theory of Heat.

ELECTIVE COURSES.

In addition to the above, Cadets who display the greatest ability in the required course are permitted to take extra courses in the laboratories. In the third class this consists of a course in the chemical preparation and study of explosive substances. In the second class they are permitted to elect between a continuation of the chemical course into qualitative analysis or a course in electrical measurements. In the first class, Cadet-Midshipmen, the work consists of a continuation of the electrical measurements of the second class, together with measurements in light and heat.

Cadet-Engineers of the first class have additional practical exercises in chemical analysis every Saturday morning, while the Cadet-Midshipmen exercise in seamanship.

DEPARTMENT OF MECHANICS AND APPLIED MATHEMATICS.

The differential and integral calculus.—The principles of the differential calculus, including Taylor's theorem, applications to problems of maxima and minima, and the tracing of curves; the methods of integration and the application of the integral calculus to areas, surfaces, and volumes, and to the finding of centres of gravity and moments of inertia, and to the simpler cases of differential equations.

Mechanics.—*Statics*, including the theory of friction, adhesion, and stiffness of cordage. *Dynamics*, including the motion of projectiles in a non-resisting medium and in air; motions of translation and of rotation of bodies about an axis; falling bodies; central forces; the simple and the compound pendulum; the laws of planetary motion; work and conservation of energy.

Hydrostatics.—Mechanical properties of fluids; the laws of equilibrium and pressure; the flotation of bodies; the stability and oscillations of floating bodies; specific gravity; the motion of liquids. *Aëriform fluids.*—Laws of pressure; weight and pressure of the atmosphere; density and temperature; the barometer, the siphon, and the pump.

The strength and resistance of materials.*—Simple and compound stresses; the relations between strain and stress; the strength and stiffness of beams; beams of uniform resistance.

The method of least squares.*—The theory of the method of least squares and the application of the method to results derived from experiments.

Theoretical naval architecture.*

Text-books.—Rice and Johnson's Differential Calculus; Williamson's Integral Calculus; Todhunter's Mechanics for Beginners; Smith's Hydrostatics; Rankine's Applied Mechanics; Merriman's Method of Least Squares; Wilson's Theoretical and Practical Ship Building.

ELECTIVE COURSES.

Cadets who have completed the elective course in mathematics are permitted to take an advanced course in integral calculus and analytical mechanics.

---

* Cadet-Engineers only.

The course in Theoretical Naval Architecture is elective for Cadet-Midshipmen.

Text-books.—Williamson's Integral Calculus, and Tait and Steele's Dynamics of a Particle.

DEPARTMENT OF ENGLISH STUDIES, HISTORY, AND LAW.

LAW.—Constitution of the United States.

International law:—rights and duties of nations in peace and war; rights of interference, of jurisdiction over the sea, of commerce, of passage over land and navigable rivers; duties of ministers, consuls, and naval commanders; kinds of property liable to capture; domicile; privateering; prizes; *jus postliminii;* rights and duties of neutrals; contraband; blockade; right of search; ship's papers; offences against the law of nations.

Outlines of maritime law.

Lectures.

Text-books.—Woolsey's International Law; Andrews's Manual of the Constitution.

HISTORY.—Origin and ethnological grouping of Aryan, Semitic, and Turanian nations; outlines of history, especially the history of Greece and Rome, of the Holy Roman Empire, and of the states of Western Europe down to 1875; historical geography; progress of colonial development in America; history of the United States; naval history; lectures.

Text-books.—Freeman's General Sketch of History, with Labberton's Historical Atlas; Eliot's History of the United States, with modern atlases.

RHETORIC AND COMPOSITION.—Essential properties of style; classification of sentences; rules for the construction of sentences; figures of rhetoric; exercises in the composition of themes and official reports.

Text-book.—Bain's Rhetoric.

ENGLISH.—Historical development of the English language; relation of English to the other Aryan languages; changes wrought by foreign influence on the grammar, vocabulary, and pronunciation. Etymology. Syntax; analysis of sentences.—Readings from standard authors, with applications of the principles of grammar, and exercises in analysis and in tracing the etymological meaning of words.—Classification of words; definition of words by usage and by derivation; synonyms; laws of change in the meaning of words by contraction, extension, and amelioration.—Faults in diction, and their remedies; selection and arrangement; elementary principles of reasoning.

Text-books.—Tancock's English Grammar and Reading Book; Seeley and Abbott's English Lessons; Hart's Manual of Punctuation.

DEPARTMENT OF MODERN LANGUAGES.

FRENCH AND SPANISH LANGUAGES.—Grammar; exercises in reading, writing, and conversation.

Text-books.—Keetel's French Grammar; La Fontaine's Fables; Prud'homme's French Nautical Phrases; Erckmann-Chatrian's *Le Conscrit* and *Waterloo;* Gasc's Dictionary; Roget's Spanish Manual; Tolon's Reader; Barretti's Dictionary.

DEPARTMENT OF DRAWING.

Right-line drawing; free-hand drawing and perspective; topographical and chart drawing.

The foregoing studies are distributed over four years, and the Cadets are arranged in four classes, each class pursuing the course for the corresponding year.

PROGRAMME OF RECITATIONS.

The time devoted to daily recitations is divided into three periods, indicated thus:—(1), (2), (3). (1) denotes first period, from 8.20 a. m. to 10.20 a. m.; (2) denotes second period, from 10.35 a. m. to 12.35 p. m.; and (3) denotes third period, from 2 p. m to 4 p. m.

Practical exercises begin on Saturdays at 8 a. m., from October 1 to December 15, and from March 10 to June 1; and at 10.45 a. m. from December 15 to March 10. On other days except Sundays practical exercises begin at 4 p. m.

FIRST TERM.

From October 1, 1878, *to February* 1, 1879.

CADET-MIDSHIPMEN.

Departments.	Periods.	Subjects.
	FOURTH CLASS—FIRST YEAR.	
Mathematics	M. T. W. Th. (2) F. S. (1)	Algebra and Geometry. Elective Course once a week.
English Studies, History, and Law	M. T. W. Th. (1) F. (2)	English and History.
Modern Languages	1st division, M. T. Th. (3) 2d division, M. W. F. (3)	Keetel's French Grammar.
Drawing	1st division, W. F. (3) 2d division, T. Th. (3)	Free-hand Drawing.
	THIRD CLASS—SECOND YEAR.	
Mathematics	M. T. W. Th. (1) F. (2)	Trigonometry and Descriptive Geometry.
	F. (3)	Descriptive Geometry. Elective Course once a week.
English Studies, History, and Law	M. (2) W. (3) F. (1)	History and Rhetoric.
Physics and Chemistry	T. W. Th. (2)	Elementary Physics.
Modern Languages	T. Th. (3)	French.
Drawing	M. (3) S. (1)	Free-hand Drawing.
	SECOND CLASS—THIRD YEAR.	
Seamanship	M. (3) F. (2) S. (1)	Luce's Seamanship.
Ordnance and Gunnery	Th. (3)	Infantry Tactics and Ordnance Instructions.
Astronomy, Navigation, and Surveying	T. (3) W. Th. (2)	Astronomy.
Mechanics and Applied Mathematics	M. T. W. Th. F. (1)	Calculus. Elective Course twice a week.
English Studies, History, and Law	One period a month*	Composition.
Modern Languages	M. T. (2) W. F. (3)	French.
	FIRST CLASS—FOURTH YEAR.	
Seamanship	T. Th. (3)	Ship-Building
	F. (3)	Luce's Seamanship.
Ordnance and Gunnery	T. (2) W. (3)	Ordnance and Armor.
Steam-Engineering	W. Th. (2) F. (1)	Marine Engines.
Astronomy, Navigation, and Surveying	M. T. W. Th. (1)	Navigation.
Physics and Chemistry	M. F. (2) S. (1)	Heat and Light.
Modern Languages	M. (3)	Spanish.

CADET-ENGINEERS.

Departments.	Periods.	Subjects.
	FOURTH CLASS—FIRST YEAR.	
Mathematics	M. T. W. Th. (2) F. S. (1)	Algebra and Geometry. Elective Course once a week.
Steam-Engineering	1st division, W. F. (3) 2d division, T. Th. (3)	Mechanical Drawing.
English Studies, History, and Law	M. T. W. Th. (1) F. (2)	English and History.
Modern Languages	1st division, M. T. Th. (3) 2d division, M. W. F. (3)	Keetel's French Grammar.

CADET-ENGINEERS—Continued.

Departments.	Periods.	Subjects.
	THIRD CLASS—SECOND YEAR.	
Mathematics	M. T. W. Th. (1) F. (2)	Trigonometry and Descriptive Geometry.
	M. (3)	Descriptive Geometry.
		Elective Course once a week.
Steam-Engineering	F. (3) S. (1)	Mechanical Drawing.
Physics and Chemistry	T. W. Th. (2)	Elementary Physics.
English Studies, History, and Law	M. (2) W. (3) F. (1)	History and Rhetoric.
Modern Languages	T. Th. (3)	French.
	SECOND CLASS—THIRD YEAR.	
Steam-Engineering	M. Th. (3) F. (2) S. (1)	Mechanical Drawing, Marine Engines, and Fabrication of Machinery.
Astronomy, Navigation, and Surveying	T. (3) W. Th. (2)	Astronomy.
Mechanics and Applied Mathematics	M. T. W. Th. F. (1)	Calculus.
		Elective Course twice a week.
English Studies, History, and Law	One period a month*	Composition.
Modern Languages	M. T. (2) W. F. (3)	French.
	FIRST CLASS—FOURTH YEAR.	
Seamanship	T. Th. (3)	Ship-Building.
Steam-Engineering	M. T. W. Th. F. (1) W. F. (3)	Marine Engines, Fabrication and Designing of Machinery, Mechanical Drawing.
Physics and Chemistry	M. F. (2) S. (1)	Heat and Light.
Mechanics and Applied Mathematics	T. W. Th. (2)	Strength of Materials.
Modern Languages	M. (3)	Spanish.

*Theme Periods.—1. Oct. 8, T. (1), Mechanics. 2. Nov. 11, M. (3) { C. M., Seamanship, / C. E., Steam. } 3. Dec. 3, T, (2), Modern Languages. 4. Jan. 2, Th. (2), Navigation.

SECOND TERM.

From February 1, 1878, *to June* 1, 1879.

CADET-MIDSHIPMEN.

Departments.	Periods.	Subjects.
	FOURTH CLASS—FIRST YEAR.	
Mathematics	M. T. W. Th. F. (2) S. (1)	Algebra and Geometry.
		Elective Course once a week.
English Studies, History, and Law	M. T. W. Th. F. (1)	English and History.
Modern Languages	1st division, M. T. Th. (3) / 2d division, M. W. F. (3)	French.
Drawing	1st division, W. F. (3) / 2d division, T. Th. (3)	Topography.
	THIRD CLASS—SECOND YEAR.	
Mathematics	M. T. W. Th. F. (1)	Analytical Geometry and Descriptive Geometry.
		Elective Course once a week.
	F. (3)	Descriptive Geometry.
Physics and Chemistry	T. Th. F. (2)	Chemistry.
English Studies, History, and Law	M. W. (2) S. (1)	History and Rhetoric.
Modern Languages	T. W. Th. (3)	French.
Drawing	M. (3)	Free-hand Drawing.
	SECOND CLASS—THIRD YEAR.	
Seamanship	T. (3) F. (2) [and Th. (3) to March 10]	Luce's Seamanship.
	Th. (2)	Naval Tactics.
Ordnance and Gunnery	T. (2)	Ordnance Instructions.
Physics and Chemistry	M. W. (2) S. (1) [and Th. (3) from March 10 to June 1]	Electricity.

CADET-MIDSHIPMEN—Continued.

Departments.	Periods.	Subjects.
	SECOND CLASS—THIRD YEAR.	
Mechanics and Applied Mathematics	M. T. W. Th. F. (1)	Mechanics. Elective Course twice a week.
English Studies, History, and Law	One period a month*	Composition.
Modern Languages	M. W. F. (3)	Spanish.
	FIRST CLASS—FOURTH YEAR.	
Seamanship	M. W. (2) S. (1)	Luce's Seamanship.
Ordnance and Gunnery	M. Th. (3) T. (1)	Ordnance and Armor.
Steam-Engineering	W. F. (3) Th. (2)	Marine Engines.
Astronomy, Navigation, and Surveying	M. W. Th. F. (1)	Navigation and Surveying.
Mechanics and Applied Mathematics	Th. (2)	Elective Course in Naval Architecture.
English Studies, History, and Law	T. F. (2)	Public Law.
Modern Languages	T. (3)	Spanish.

*Theme Periods.—1. Oct. 8, T. (1), Mechanics. 2. Nov. 11, M. (3) {C. M., Seamanship, / C. E., Steam.} 3. Dec. 3, T. (2), Modern Languages. 4. Jan. 2, Th. (2), Navigation.

CADET-ENGINEERS.

Departments.	Periods.	Subjects.
	FOURTH CLASS—FIRST YEAR.	
Mathematics	M. T. W. Th. F. (2) S. (1)	Algebra and Geometry. Elective Course once a week.
Steam-Engineering	1st division, W. F. (3) / 2d division, T. Th. (3)	Mechanical and Drawing.
English Studies, History, and Law	M. T. W. Th. F. (1)	English and History.
Modern Languages	1st division, M. T. Th. (3) / 2d division, M. W. F. (3)	French.
	FIRST CLASS—SECOND YEAR.	
Mathematics	M. T. W. Th. F. (1)	Analytical Geometry and Descriptive Geometry. Elective Course once a week.
	M. (3)	Descriptive Geometry.
Steam-Engineering	F. (3)	Mechanical Drawing.
Physics and Chemistry	T. Th. F. (2)	Chemistry.
English Studies, History, and Law	M. W. (2) S. (1)	History and Rhetoric.
Modern Languages	T. W. Th. (3)	French.
	SECOND CLASS—THIRD YEAR.	
Steam-Engineering	T. Th. F. (2) T. (3) [and Th. (3) to March 10.]	Mechanical Drawing, Fabrication of Machinery, and Marine Engines.
Physics and Chemistry	M. W. (2) S. (1) [and Th. (3) from March 10 to June 1.]	Electricity.
Mechanics and Applied Mathematics	M. T. W. Th. F. (1)	Mechanics. Elective Course twice a week.
English Studies, History, and Law	One period a month*	Composition.
Modern Languages	M. W. F. (3)	Spanish.
	FIRST CLASS—FOURTH YEAR.	
Steam-Engineering	M. W. Th. F. S. (1) W. (2) Th. F. (3).	Marine Engines, Fabrication and Designing of Machinery, and Mechanical Drawing.
Physics and Chemistry	T. (1) M. W. (3)	Physical Measurements.
Mechanics and Applied Mathematics	M. (2)	The Method of Least Squares.
	Th. (2)	Naval Architecture.
English Studies, History, and Law	T. F. (2)	Public Law.
Modern Languages	T. (3)	Spanish.

*Theme Periods.—1. Feb. 7, F. (2), {C. M., Seamanship, / C. E., Steam.} 2. Mar. 11, Tu. (1), Mechanics. 3. Apr. 11, F. (3), Modern Languages. 4. May 5, M. (2), Physics and Chemistry.

EXAMINATION PAPERS—1877-78.

FOURTH CLASS.

DEPARTMENT OF MATHEMATICS.

ALGEBRA.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1878.—*Time allowed, five hours.*

[Two questions may be omitted.]

1. Simplify $(a+b)^2\ (b+c-a)\ (c+a-b)+(a-b)^2\ (a+b+c)\ (a+b-c)$. Divide $x^9-3x^8-31x^7+25x^6+3x^5-15x^4-8x^3+19x^2+3x+10$ by x^4-7x^3+3x-2, giving the quotient and remainder. Resolve into factors $a^2+9ab+20b^2$, $x^2-13xy+42y^2$, $x^6+y^6-2x^3y^3$, and x^3-3x+2.

2. Find the greatest common divisor of x^3-4x^2+2x+3, and $2x^4-9x^3+12x^2-7$, and the least common multiple of x^2+2x-3, x^3+3x^2-x-3, and x^3+4x^2+x-6.

3. Simplify

$$\frac{1}{x^2-7x+12}+\frac{2}{x^2-4x+3}-\frac{3}{x^2-5x+4},$$

and

$$\frac{x^2+(a+c)\,x+ac}{x^2+(b+c)\,x+bc}\div\frac{x^2-a^2}{x^2-b^2}.$$

Find the value of

$$\frac{x}{a}+\frac{x}{b-a}-\frac{a}{a+b}$$

when

$$x=\frac{a^2(b-a)}{b(b+a)}.$$

4. Solve the equations

$$\frac{3x-1}{5}-\frac{13-x}{2}=\frac{7x}{3}-\frac{11}{6}(x+3),$$

$$\frac{x-a}{x-b}=\frac{(2x-a)^2}{(2x-b)^2},$$

$$\sqrt{x+14}+\sqrt{x-14}=14,$$

and

$$\frac{x+10}{3}-\frac{2}{5}(3x-4)+\frac{(3x-2)(2x-3)}{6}=x^2-\frac{2}{15}.$$

5. Prove that if

$$\frac{a}{b}=\frac{c}{d},$$

then

$$\frac{a+b}{a-b}=\frac{c+d}{c-d}.$$

Prove that when a and b are unequal $a^2+b^2>2ab$. Find which is the greater,

$$2+\sqrt{3}\text{ or }5-\sqrt{2}.$$

Find the square root of

$$\frac{19}{15}-2\sqrt{\frac{2}{5}}.$$

6. Write the 2d, 3d, and 4th powers of $3-\sqrt{5}$, and the 3d and 4th powers of $x+2y+3z$. Find the coefficient of x^7y^3 in the expansion of $(x+y+z)^{10}$.

7. Find the cube root of 418.9 to five decimal places. Expand

$$\frac{1}{\sqrt{a^2-x^2}}$$

to five terms by the binomial formula.

8. Solve the equations

$$\frac{x-1}{x-4}-\frac{x-3}{x-2}=\frac{11}{12},\quad (x+10)^2=144\,(100-x)^2,$$

and

$$x^4-4x^2+2\sqrt{x^4-4x^2+4}=31.$$

9. Show that

$$\frac{bc\,(a+d)}{(a-b)\,(a-c)}+\frac{ac\,(b+d)}{(b-a)\,(b-c)}+\frac{ab\,(c+d)}{(c-a)\,(c-d)}=d.$$

Resolve $2x^2y^2+2x^2z^2+2y^2z^2-x^4-y^4-z^4$ into four factors.

10. Solve the equations

$$\sqrt{\frac{x^2-2x+3}{x^2+2x+4}}+\sqrt{\frac{x^2+2x+4}{x^2-2x+3}}=2\tfrac{1}{2},$$

and

$$\frac{x+y}{4}=\frac{xy}{x+y}+\frac{1}{z},\quad x^2+y^2=\frac{8x^2y^2}{(x+y)^2}+22.$$

11. The distance between two termini, A and F, of a railway is 100 miles; a train starting from A runs up grade for 30 miles, the next 50 miles are on a level, and the remainder is up hill again. The train makes 5 miles an hour more on a level than when ascending a grade. There are four stops at stations B, C, D, and E, at distances 20, $42\frac{1}{2}$, $67\frac{1}{2}$, and 90 miles from A respectively; each stop causes a detention of 3 minutes. Find the time of arrival at each of the stations of a train which leaves A at 8 and arrives at F at 12.42.

ANNUAL EXAMINATION.

JUNE, 1878.—*Time allowed, five hours.*

[Two questions may be omitted.]

1. Deduce the formula for the sum of an arithmetical progression in terms of a, d, and n. Deduce a formula for n in terms of a, d, and s. Find the sum of n terms of a series whose nth term is $\frac{4n+1}{5}$, and find the nth term of a series whose sum is $\frac{9n^2+19n}{4}$.

2. Find the sum of 15 terms of the series $\frac{2}{3}+\frac{5}{7}+\frac{16}{21}+$ &c. Find the sum to infinity of $2+\frac{2}{\sqrt{3}}+\frac{2}{3}+$ &c. The sum of an infinite geometrical progression is 3, and the sum of the first two terms is $2\frac{3}{4}$; find the series.

3. Expand $\sqrt{1+x+x^2+x^3+}$ &c. to four terms by means of indeterminate coefficients. Separate $\frac{x^2-3x+1}{(x^2-8x+12)\,(x^2+x-20)}$ into partial fractions, with denominators of the first degree.

4. Find the first three terms of a series whose $(n+1)$th term is $\frac{(n+7)\,(n-5)}{(n+1)\,(n^2+1)}\cdot 2^n$. How many different signals may be made with twelve different flags hoisted one above another, four at a time? In how many of these signals will a particular flag occur?

5. Find the value of the expression $\left\{\frac{a^3b^2c+a^2b^3c^2}{d^3ef^2+d^2e^4f}\right\}^{\frac{1}{13}}$, given a, .15736; b, 481.92; c, .056894; d, .00043141; e, 5.8404; f, 98218.

6. Find the value of the following expressions:

$$(1.007)^{234},\ (.001875)^{\frac{1}{3}},\text{ and }(.001875)^{.001875}.$$

Find the modulus of a system of logarithms whose base is ε^2.

7. Find an equation whose roots are less by 5 than those of the equation $x^4+25x^3-70x^2+16x-972=0$. Transform the equation $x^3-6x^2+9x-10=0$ into

another wanting the second term, and into two others each wanting the third term. Find an equation whose roots are $3 \pm \sqrt{5}$ and $7 \pm \sqrt{2}$, and find all the roots of the equation $x^5 - 3x^4 - 9x^3 + 21x^2 - 10x + 24 = 0$.

8. Solve the equation $x^4 + 4x^3 - 10x^2 + 4x + 1 = 0$. Transform the equation $x^3 + ax^2 + bx + c = 0$ to another, whose roots are the squares of the roots of the given one; thence find an expression for the sum of the squares of the roots of the given equation.

9. Find, by means of indeterminate coefficients, the sum of n terms of the series $2 + 5 + 9 + 14 + 20 +$ &c. The number of combinations of $n + 2$ things taken three together is 11 times the number of combinations of $\frac{2n}{3}$ things taken two together; find n.

10. Trace the locus of the equation

$$4y^2 - 4xy + 5x^2 - 32y - 16x - 68 = 0.$$

11. Given the equations $x^2 + y = 11$, $y^2 + x = 7$; find the commensurable values of x and y; find also a positive value of x to five decimal places.

GEOMETRY.

ANNUAL EXAMINATION.

JUNE, 1878.—*Time allowed, five hours.*

[Two questions may be omitted.]

1. Define *right angle, perpendicular*, and *geometric locus;* give three examples of the latter. Prove that the sum of the angles of a triangle is two right angles. Name and define the different classes of quadrilaterals and parallelograms, giving a figure of each.

2. Define *circle, chord, sector*, and *segment*. Prove that an inscribed angle is measured by one-half the intercepted arc. *Construct* common tangents to two circles, interior and exterior, and explain the construction.

3. Explain the terms *similar polygons, homologous lines, ratio of similitude*. When are triangles similar? (Quote the propositions.) Prove that the bisector of an angle of a triangle, or of its exterior angle, divides the opposite side into segments, internally or externally, which are proportional to the adjacent sides.

4. Give the geometrical proof that the sum of the squares described upon the sides of a right triangle is equivalent to the square described upon the hypothenuse. Divide a line 3 inches long in extreme and mean ratio; explain the construction and give algebraic expressions for the segments.

5. What is a *regular polygon?* What is the *apothegm?* Show how to inscribe a square, hexagon, and decagon in a circle (give a brief proof in each case). Prove that the area of a regular dodecagon is three times the square of the radius.

6. Define *polyedron, regular polyedron, prism*, and *parallelopiped*. What regular polyedrons are there? Prove that the volume of any parallelopiped is equal to the product of its base by its altitude, and that a triangular pyramid is one-third of a triangular prism of the same base and altitude.

7. Define *conical surface, nappes, generatrix, directrix, element*. Through a given point pass a plane tangent to a given cylinder. Define *spherical triangle, polar triangles*. Prove that in two polar triangles each angle of the one is measured by the supplement of the side lying opposite to it in the other.

8. Define sine, cosine, tangent, and secant; find these functions of the angles 30°, 45°, 60°, 22½°, and 18°.

9. The sides of a right triangle are a and b, hypothenuse c; upon the side b a similar triangle is described with b as its hypothenuse, and upon the corresponding side of this another similar triangle is described in the same manner, and so on *ad infinitum;* find the sum of the areas of all these triangles.

10. The figure being drawn for the proposition in question 4, let AB be the hypothenuse, CF the perpendicular upon it from the right angle, AD and BE, lines drawn to the most distant corners of the square described on BC and AC; prove that CF, AD, and BE meet in a point.

11. In the preceding question, the hypothenuse being fixed, find the locus of the point C, and also of the points D and E.

THEORY OF EQUATIONS.

ELECTIVE COURSE.

JUNE, 1878.—*Time allowed, five hours.*

Cadet-Midshipmen J. L. Shock, J. H. Linnard, J. L. Rees, Tasuker Serata, Eugene Carroll, and J. J. Woodward.

1. Given the equation $(y-2x)(y^2-x^2)-a(y-x)^2+4a^2(x+y)-a^3=0$.

( ) Find the equations to the asymptotes.

(β) Find the co-ordinates of the intersections of the curve with its asymptotes.

(γ) Denoting these co-ordinates by (x_1, y_1), (x_2, y_2), (x_3, y_3), show that

$$\begin{vmatrix} x_1, & y_1, & 1 \\ x_2, & y_2, & 1 \\ x_3, & y_3, & 1 \end{vmatrix} = 0.$$

(δ) Find to the nearest *tenth* in terms of a the distance from the origin to each of the points where the curve crosses the axes.

(ε) Make a sketch of the locus, using only the data already determined.

2. Discuss by means of Sturm's functions the equation $x^4-3x^3+9x^2+2x-1=0$. ($f_4(x)$ is negative.) Find the value of the *numerically* greatest root to eight decimal places.

3. Find the values of the symmetrical functions $\Sigma(a^4)$ and $\Sigma(a^2\beta^2)$ of the roots of $f(x)=0$ in terms of the coefficients p_1, p_2, &c. Given $x+y+z=0$, $(b+c)x+(c+a)y+(a+b)z=0$, $bcx+acy+abz=1$; find x, y, and z by means of determinants.

4. Trace the locus of the equation $ax^2(y-a)=y^3(x-2a)$, and find the co-ordinates of the points where the tangent is parallel to the axis of X.

5. Trace the locus of the equation $a^2(x^2-y^2)+2axy^2+ay^3-x^4-x^2y^2=0$.

DEPARTMENT OF ENGLISH STUDIES, HISTORY, AND LAW.

HISTORY.

SEMI-ANNUAL EXAMINATION.

JANUARY 30, 1878.—*Time allowed, five hours.*

1. Fix the geographical position of the following nations, and tell what you can of the classification and language of each: 1. Bulgarians; 2. Roumanians; 3. Magyars; 4. Turks; 5. Russians.

2. "The best life of Scandinavia went out into other lands to put new life into them." Give some instances of this.

"He won the rank of Roman emperor for the German kings." Who is alluded to in this passage, and how was the transfer in question accomplished?

3. Name the seven electors. How was it that the mediæval Roman empire was both elective and hereditary, while the French monarchy became strictly hereditary?

4. Show that the later Roman republic was nominally a pure democracy, but with aristocratic tendencies.

5. What change was made in the relations of England and Scotland in 1603? in 1707? What did Edward III. give up by the peace of Bretigny? What did he keep?

What change did Simon of Montfort make in the English Parliament, and when? How was Normandy lost to England? How did the Angevin kings come to the throne of England?

6. Explain the origin and meaning of the names Protestant, Maid of Orleans, Latin Empire of Constantinople, Babylonish Captivity, Pagan, Langue d'oc and Langue d'oil.

7. Describe the government of Venice in the fifteenth century, and show how it differed from that of Florence. Compare the origin and position of the Medici at Florence with those of Sforza at Milan.

8. "At the moment that Greece began to lose her political freedom she made an intellectual conquest of a large part of the world." Tell what this means, and show why it was so. Give some account of: 1. Miltiades; 2. Polybios; 3. Solon. Where was Mantineia, and why is it celebrated in history?

9. Distinguish between Arians and Aryans. What nation made the first conquest of what is now known as England? the second? the third? the fourth and last? Explain the difference between allodial holdings and fiefs, and show why the latter took the place of the former.

10. Draw a map of Central and Western Europe in 1400 A. D., putting down the position and boundaries of the following:

1. Agincourt.	7. Styria.	13. Prag.
2. Sempach.	8. Morgarten.	14. Milan.
3. Bohemia.	9. Avignon.	15. Crecy.
4. Mainz.	10. Geneva.	16. Provence.
5. Lorraine.	11. Pisa.	17. Courtrai.
6. Köln.	12. Constanz.	18. Savoy.

HISTORY OF THE UNITED STATES.

ANNUAL EXAMINATION.

JUNE 5, 1878.—*Time allowed, five hours.*

[Starred (*) questions are alternatives.]

1. What is a representative assembly? What was the first representative assembly in America? What was the general character of the assemblies in the colonies? Describe the government of Plymouth Colony.

2. Compare the policy of Maryland with that of Massachusetts and Rhode Island, in regard to religious toleration, and explain the causes in each case.

3. Make a statement of Franklin's services: 1. As deputy to the Albany convention of 1754. 2. In England, in regard to the Stamp Act. 3. In 1775. 4. In 1776–'78. 5. In 1783. 6. In 1787.

3.* Describe the work of the three French explorers: 1. Marquette; 2. La Salle; 3. D'Iberville.

4. Give some account of the financial measures adopted at the beginning of Washington's administration.

4.* Explain the party divisions in the Constitutional Convention, and state the points in discussion on the question of apportionment of representation, showing how the question was settled.

5. Give some account of the following: 1. Affair of the Chesapeake. 2. Greene's campaign in South Carolina during the Revolution. 3. Jackson in Louisiana in the war of 1812. 4. Affair of the Caroline. 5. Wilmot Proviso. 6. Dred Scott case. *Take four.*

6. Describe the actions on the lakes in the war of 1812.

6.* Describe the English naval and military expedition on Baltimore and Washington.

7. Explain the Monroe Doctrine, and show how far it influenced American politics.

8. Explain tariff, protection, prohibition, free trade. Explain the tariff measures of 1816, 1828, and 1832, and give an account of the action of South Carolina in reference to the last.

9. Give an account of General Scott's campaign from Vera Cruz to the City of Mexico.

9.* Give an account of the repeal of the Missouri Compromise, and explain its connection with the civil war in Kansas.

10. Draw a map of the States south of the Ohio River, putting down the following:

1. Ohio River.
2. Mississippi River.
3. Kentucky River.
4. Cumberland River.
5. Knoxville.
6. Corinth.
7. Lexington.
8. Louisville.
9. Perrysville.
10. Chickamauga.
11. Vicksburg.
12. Memphis.
13. Fort Donelson.
14. Fort Pillow.
15. Nashville.
16. Chattanooga.
17. Port Hudson.
18. New Orleans.

ENGLISH GRAMMAR.

SEMI-ANNUAL EXAMINATION.

JANUARY 28, 1878.—*Time allowed, five hours.*

1. Explain the term Norman Conquest as applied to the English language. How did the Norman Conquest affect the English vocabulary?

2. What is meant by Classical Latin, and how did it affect the language of England?

3. Describe the early loss of inflections in Northern England, and account for the difference between the South and North in this respect.

4. To what extent is an English verb inflected? In the absence of inflections, how are moods and tenses distinguished? (Explain each mood and tense.) Explain aorist tense, finite verb, strong conjugation.

5. Give all the plurals of the following, adding the rule in the first four cases: 1. Bandit; 2. Echo; 3. Child; 4. Commander-in-chief; 5. Cherub; 6. Trellis; 7. Oasis; 8. Fief; 9. Sheaf; 10. Talisman. Explain the formation of: 1. Youngster; 2. Kine; 3. Children; 4. Vixen; 5. Rather.

6. (*a*) Explain the force of *shall* and *will* in the following: 1. I say that you *will* go. 2. You say that he *shall* go. 3. He says that he *shall* go. 4. I say that I *will* go.

(*b*) Explain the terminations in *liquefy, verbose, ringlet.*

7. Analyze:

"If, by gaining knowledge, we destroy our health, we labor for a thing that will be useless in our hands; and if, by harassing our bodies (though with a design to render ourselves more useful), we deprive ourselves of the ability of doing the good we might have done with a meaner talent, which God thought sufficient for us by having denied us the strength to improve it to that pitch which men of stronger constitutions can attain to, we rob God of so much service, and our neighbor of all that help which, in a state of health, we might have performed."

8. *As* it is in the body, so *it* is in the mind; practice *makes it what it* is; and *most, even* of *those* excellencies *which* are looked on as natural endowments, will be *found,* when *examined into* more narrowly, to be the product of exercises, and to be raised to that pitch only by repeated actions. Some men are remarked for their skill in raillery, others for diverting stories. *This* is *apt to be taken* for the effect of pure nature, and that, the *rather,* because it is not *got* by rules, and those who excel in *either* of them never *set* themselves to the study of it *as* an art *to be learnt.* Parse all the words underscored, classifying and explaining the principal parts of the verbs.

ENGLISH LESSONS.

ANNUAL EXAMINATION.

JUNE 10, 1878.—*Time allowed, five hours.*

1. "To increase one's vocabulary does not imply increasing the number of one's notions." Show this.

Explain generalizing. What is meant by false generalization?

2. Name the laws of linguistic change and give an illustration of each, showing from the etymology of the word how the law applies.

3. Show that impassioned prose may approximate to the (*a*) metre, (*b*) brevity, of poetry. In what point does the best prose of this kind keep itself distinct from poetry? When are poetic quotations and periphrases admissible and when not?

4. Explain, with original examples, personification and personal metaphor, and show why one admits of expansion and the other does not.

5. Define rhetorical period, epic poem, dramatic poem, syllogism, convertible proposition.

6. Show that the value of evidence depends on all the other sources of knowledge. What is meant by false generalization? by authority as a source of prejudice? by the argument from analogy?

7. Explain all the figures in the following passage:

> "I have marshalled my clan;
> Their swords are a thousand; their bosoms are one.
> They are true to the last of their blood and their breath,
> And like reapers descend to the harvest of death.
> Then welcome be Cumberland's steed to the shock!
> Let him dash his proud foam like a wave on the rock!
> But woe to his kindred, and woe to his cause,
> When Albyn her claymore indignantly draws."

8. "Anything is excused by necessity. I am under the necessity to preserve my life. Anything that I do to preserve my life is excusable." Explain fully this form of reasoning, and discuss the question as to the correctness of the inference. Point out the major term, middle term, minor premise.

9. "As a promise or contract between two individuals obtained by compulsion is void, so a treaty of peace, in which the victorious enemy has dictated terms to the vanquished, may be broken by the latter at pleasure." Discuss this and point out any error you may see.

10. Make a prose version of the following passage, suppressing rhyme, metre, and poetic diction:

> "The curfew tolls the knell of parting day;
> The lowing herds wind slowly o'er the lea,
> The ploughman homeward plods his weary way,
> And leaves the world to darkness and to me.
>
> "Now fades the glimmering landscape on the sight,
> And all the air a solemn stillness holds,
> Save where the beetle wheels his droning flight,
> And drowsy tinklings lull the distant folds.
>
> "Save that from yonder ivy-mantled tower
> The moping owl does to the moon complain
> Of such as, wandering near her secret bower,
> Molest her ancient solitary reign."

DEPARTMENT OF MODERN LANGUAGES.

FRENCH.

ANNUAL EXAMINATION.

JUNE 10, 1876.—*Time allowed, four hours.*

Translate into French the following sentences:

1. Do you expect to go to France in the spring?
2. We intend going there. I would like to go, because I speak French.
3. How long will you remain in Europe?
4. We propose staying one year in France, afterwards six months in Germany; at the end of eighteen months we will return to America.
5. Can you tell me which is the most populous and most commercial city in France?
6. I think it is Paris.
7. In what hotel do you live when you are there?
8. We stay at the Hotel du Louvre, in Rivoli street.
9. How many rooms do you generally take?
10. We always take three rooms; one for father and mother, one for sister, and one for myself.
11. Do you take with you a servant from the United States?
12. Yes, sir; because we have had him a long time, and also because father does not speak French.
13. What do you do in the evening to pass the time?
14. After dinner, if the weather is fine, we take a drive, sometimes we walk, and we often go to the theatre.
15. Do you ever visit other cities in France?
16. We have visited a great many cities in that country, but never many in Germany; but this time we intend visiting the principal cities of that empire.
17. Why don't you go to Italy also?
18. If father's affairs and health allow it, I hope to have that pleasure.
19. If you do go, I will send you letters of introduction to my friends.
20. I am delighted to hear you say so, and thank you very much.

THIRD CLASS.

DEPARTMENT OF MATHEMATICS.

TRIGONOMETRY.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1878.—*Time allowed, five hours.*

[Solutions of ten questions required.—Without tables.]

1. Define *sine* and *cosine*. The sines and cosines of two angles being given, find the sine and cosine of their sum and difference. Deduce formulas for the tangent of $(x \pm y)$, and for the sum and difference of the sines and cosines of x and y.

2. Deduce formulas expressing the sine, cosine, and tangent of $2x$ and $\frac{1}{2}x$ in terms of the functions of x. Find the sine and cosine of 30° and 45° and thence derive the sine and cosine of 15° and 22½°. Find the sine and cosine of 18°. Find the square root of $\cos\theta + \sqrt{-1}\sin\theta$.

3. Give a rule for finding the circular measure of an arc which is expressed in degrees and minutes, and for finding the degrees and minutes in an arc expressed in circular measure. What is the unit of circular measure? What is meant by the equation

$\theta = \tan^{-1} 2\,\theta$. Give one solution. Find the value of $\sin(\sin^{-1}\frac{1}{2} + \cos^{-1}\frac{1}{2})$. Solve the equation $\tan^{-1}\frac{1}{4} + 2\tan^{-1}\frac{1}{5} + \tan^{-1}\frac{1}{6} + \tan + \frac{-1}{x} = \frac{\pi}{4}$.

4. Find an expression for $\cos\frac{21}{2}A$ in a plane triangle in terms of the sides. Deduce formulas for the solution of a plane triangle by means of a perpendicular, (1) when a, b, and A are given, (2) when a, b, and c are given.

5. One side of a triangle is double another and the included angle is 60°; find the other angles. The sides of a triangle are $x^2 + x + 1$, $x^2 - 1$, and $2x + 1$; find the angle opposite the side $x^2 + x + 1$, and the area of the triangle.

6. State the *three-point problem* and deduce formulas for its solution. Find formulas for the logarithmic solution of $m \cos z + n \sin z = q$, and $\tan(+z) \tan z = m$.

7. Derive the formula $\sin a \sin B = \sin b \sin A$, directly from

$$\cos a = \cos b \cos c + \sin b \sin c \cos A.$$

Find an expression for $\cos\frac{21}{2}A$ in a spherical triangle in terms of the sides; apply this formula to the astronomical triangle to find Z, when d, h, and L are given. Arrange a form for computation.

8. Deduce directly from the fundamental theorems of spherical trigonometry all the formulas used in the solution of right triangles. Give the rule for drawing the perpendicular in the solution of oblique triangles. One side of a triangle is 90° and the adjacent angles are 30° and 45°; find the other angle.

9. In a plane triangle, given A, 45°; B, $\tan^{-1}\frac{17}{31}$; c, 48: solve the triangle, and find the perpendicular from C upon c.

10. In a spherical triangle, given A, 30°; B, 105°; c, $\tan^{-1}2$: find a and C.

11. Derive $a \sin B = b \sin A$ from the formulas $a^2 = b^2 + c^2 - 2bc \cos A$. The shadows of two walls, which run at right angles to each other and which are respectively a feet and b feet in height, are observed when the sun is due south, and found to be c feet and d feet broad respectively; find the altitude of the sun, and the angle of the first wall with the meridian.

12. The distance between the centres of two wheels is a, and the sum of the radii is c; find the length of a string which crosses between them and just wraps around them.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1878.—*Time allowed, five hours.*

[Solutions of nine questions required.]

1. Take from the tables the following logarithms: Cosec 179° 50′ 10″, cos 189° 34′ 50″, sec − (90° 30′ 30″), tan 619° 45′ 30″. Find the angles corresponding to the tabular logarithms in the quadrants indicated, tan 8.89193 (4th), cos 8.06396 (7th), and sec 10.07938 (3d). Find the versine of chord $= \sqrt{5.3}$.

2. In a plane triangle, given A, 33° 44′ 15″; a, 140.15; b, 200.91: solve the triangle and find its area.

3. Draw a triangle ABC and let P be a point without the triangle. Find the angles CAP and CBP, given AB, 62712; BC, 39195; AC, 31356; APC, 37° 30′; BPC, 45° 30′.

4. In a plane triangle, given a, 4325; b, 5175: c, 7650; find the angles, using a perpendicular from the greatest angle upon the opposite side. Find the radii of the inscribed and circumscribed circles and the distance between their centres.

5. In a spherical triangle, given A, 129° 15′ 45″; B, 140° 4′ 15″; b, 126° 29′ 30″: find a and C.

6. In a spherical triangle, given C, 131° 11′ 12″; A, 69° 14′; b, 84° 29′ 20″: solve the triangle.

7. Given t, 30° $E.$; d, 7° 30′ $N.$; h, 45°: find L and Z. Project the triangle on the plane of the equator.

8. In the quadrilateral $ABCD$, given AB, 5280.9; BC, 6080.5; AD, 3520.6; CAB, 30° 25′; and CAD, 60° 30′: find AC and DC.

9. Find the roots of the equation $x^3 - 6x^2 + 11.25x - 6.32245 = 0$.

10. Given a, 90.024; b, 120.03; a, 19° 41′ 45″; θ, 49° 2′ 30″; ϕ, 75° 22′ 3″; and that $y < \frac{\pi}{2}$:

find x from the formulas, $\tan^2 y = \frac{4ab}{(a-b)^2} \cdot \frac{\sin\theta \sin(\phi - a)}{\sin a \sin(\phi - \theta)}$, $x = \frac{a-b}{2} \sec y - \frac{a+b}{2}$.

11. Find to the nearest second a value of θ between 66° and 67° which will satisfy the equation $\theta = \tan^{-1} 2\theta$.

DESCRIPTIVE GEOMETRY.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1878.—*Time allowed, four hours.*

[Use a fresh sheet for each question, and draw the ground-line 4 inches from the top of the page. All the work of each question must be included between two lines, one drawn on each side of the ground-line, and 2½ inches from it. A brief statement of the analysis and method of construction in each case is required.]

1. Find the intersection of two planes; (α.) the traces meet the ground-line at (0, 0, 0) and (1.5, 0, 0) and intersect at (1, 1, 0) and (0.5, θ, 1.5). (β.) The traces meet the ground-line at (1.75, 0, 0) and (3.5, 0, 0) and intersect at (2.5 3, 0) and (3, 0, 3). (γ.) The planes are parallel to the ground-line, one passes through (4.5, 2, 0) and (4.5, 0, 1), the other through (4.5, 1.5, 0) and (4.5, 0, 1.5). (δ.) The traces meet on the ground-line at (6.5, 0, 0), one passes through (5, 2.5, 0) and (7, 0, 2.5), the other through (7.5, 1.5, 0) and (5, 0, 2.5).

2. Find the point in which the line (7, 2.5, 2.5) . . . (1.5, 1, 0) pierces the plane (5.5, 0, 0), (3, 2, 0), (3, 0, 2.5). Find also where the plane is pierced by a line through (7, 1, 1) parallel to the ground-line. The vertical projection of a point in the given plane is (1.5, 0, 1.5); find its horizontal projection.

3. Through (5.5, 1, 2.5) draw a line perpendicular to a plane given as is question 2. Find the distance of the point from the plane, and project upon the plane a line which passes through the given point and (1, 2, 0).

4. Find the shortest distance from (3, 2, 2.5) to (1, 2.5, 0) . . . (3, 0, 1.25). Find the angle between two planes; the traces meet the ground-line at (4.5, 0, 0) and (7, 0, 0) and intersect at (5, 0, 2.5) and (6.5, 2.5 0).

5. Construct a regular hexagon in H, centre at (3.5, 1.25, 0), radius 1 inch, one angle being on a line joining the centre with (2.5, 0, 0). Find the projection of a pyramid whose base is the hexagon and whose vertex is (7, 2.5, 2.5). Find the true form of a section of the pyramid by the plane (6, 0, 0), (4, 2.5, 0), (4, 0, 1).

6. Through (4, 1, 1) draw a line which shall make an angle of 45° with H and 30° with V.

ANNUAL EXAMINATION.

JUNE, 1878.—*Time allowed, four hours.*

[Take a fresh sheet for each problem and give a brief statement of the methods used in the constructions.]

1. Given two lines (1, 2.25, 2.25) . . . (4, 1.75, 0), and (2.5, − 0.5, − 0.5) . . . (4.5, 1.5, 2): find the shortest distance between them.

2. Pass a plane through the point (4, 1, 1), which shall make angles of 45° and 60° with H and V, respectively.

3. In a spherical triangle, given A, 60°; b, 45°; c, 30°; make an orthographic projection of the triedral angle; take the vertex at (4, 3, 0) and place b in H, solve the triangle by revolving B and a upon H, and C upon V.

4. In a spherical triangle, given A, 45°; c, 60°; a, 45°; solve the triangle, take the vertex at (4, 2, 0) and place c in H to the right of the vertex, both solutions required.

5. A circle, radius 1 inch, is situated in the plane (1, 0, 0), (3, 4, 0), (3, 0, 1.5), the horizontal projection of the centre being at (4, 2, 0); this circle forms the base of a

right cylinder, and it is required to draw tangent planes to the cylinder through (3, 5.25, 0).

6. A circle, radius 1 inch, lies in a vertical plane and revolves about a vertical axis through (4, 2.5, 0), the initial position of the centre is (5.5, 2.5, 1.25). A plane parallel to the ground-line passes through (4, 2.5, 1.5) making an angle of 45° with both *H* and *V*. Draw the intersection of the plane with the ring which is generated by the circle. Draw a tangent to the curve at each of the points situated 1 inch above *H*.

ANALYTICAL GEOMETRY.

ANNUAL EXAMINATION.

JUNE, 1878.—*Time allowed, five hours.*

1. Given the vertices of a triangle, (4, 4), (5, 11), and (12, 10); find, (1) the equations to the sides of the triangle, (2) the angles of the triangle, (3) the area, (4) the equation to the circumscribed circle.

2. Deduce the formulas by which the axes are turned through an angle θ, the origin being fixed. Find the equation to the parabola $y^2 = 4ax$, (1) origin at $(a, 2a)$, (2) when the tangent and normal at $(a, 2a)$ are taken as axes.

3. Deduce the equations to the tangent and normal to the parabola (both forms); prove that perpendicular tangents meet on the directrix, and that the chord of contact passes through the focus. Find the equations to tangents to $y^2 = 4ax$ through $(6a, 5a)$.

4. Deduce the rectangular equation to the ellipse, (1) origin at foot of directrix, (2) at vertex, (3) at centre. Find the polar equation, pole at *left* focus, by moving the origin to that point and then transforming to polar co-ordinates. Find the length of a focal chord in terms of θ. Trace the locus of the equation $r = \frac{a(1-e^2)}{1-e\cos\theta}$, $e > 1$ from $\theta = \pi$ to $\theta = 2\pi$, showing the motion of the tracing-point by means of arrow-heads.

5. Deduce the equation to the hyperbola referred to its asymptotes. Prove that any secant intercepts equal distances between the curve and each of the asymptotes. Find the equation to the hyperbola whose transverse axis is a and whose vertex bisects the distance between the centre and the focus. The equation to a diameter to $xy = 16$ is $y = 4x$; what is the equation to the conjugate?

6. Construct the locus of the equation $y^2 - 2xy + 2x^2 + 8y + 6x + 49 = 0$. Find the equation to this conic when referred to its axes. State, and prove the method used in constructing the conic.

7. Construct the locus of the equation $y^2 - 2xy + x^2 - 8y + 9x + 10 = 0$. State and prove the method used in the construction. Find the equation to the directrix of the conic given above, and the co-ordinates of the focus.

8. Two equal parabolas have a common directrix and extend in opposite directions; it is required to find the locus of the vertex of a right angle, one of whose sides lies on each of the parabolas. Trace the curve.

DIFFERENTIAL AND INTEGRAL CALCULUS.

ELECTIVE COURSE.

JUNE, 1878.—*Time allowed, five hours.*

Cadet-Midshipmen P. R. Alger, J. B. Bernadou, L. S. Norton, H. G. Dresel, W. H. Wolfersberger, Harry Phelps, A. A. Ackerman, J. C. Drake, and G. E. West.

Cadet-Engineers W. F. Durand, W. F. C. Hasson, A. W. Stahl, W. S. Sample, and L. D. Miner.

1. Show that if U and V are such functions of x as to vanish when $x = a$, then

$$\frac{V}{U}\Big]_{x=a} = \frac{dV}{dU}\Big]_{x=a}.$$

Evaluate

$$\frac{\varepsilon^x + \log\left(\frac{1-x}{\varepsilon}\right)}{\tan x - x}\Bigg]_0, \text{ and } (1-x)^{\frac{1}{x}}\Big]_0.$$

2. Explain the terms *point of inflection*, *conjugate point*, *ramphoid* and *ceratoid cusps*, *point d'arêt*, *branche pointillée*. Trace the curve $y^x = 1 - x$.

3. Given $r \sin 4\theta = a \sin 3\theta$, find the asymptotes and trace the curve.

4. Find a general expression for the radius of curvature in $x^{\frac{2}{3}} + y^{\frac{2}{3}} = a^{\frac{2}{3}}$. Derive a formula for the radius of curvature in terms of p and r. Given $r = a \sec \frac{3\theta}{3}$, find ρ.

5. Define evolute and involute; derive formulas for the co-ordinates of a point on the evolute. Find the equation to the evolute of $x^{\frac{2}{3}} + y^{\frac{2}{3}} = a^{\frac{2}{3}}$.

6. A series of ellipses have the same centre and directrix, find the envelope.

7. Find the value of

$$\int \sin^2\theta\, d\theta, \quad \int \varepsilon^x x^2 dx, \quad \int \frac{dx}{x^2 - a^2}, \text{ and } \int_0^1 \frac{dx}{1 + x + x^2}.$$

8. Find the value of

$$\int \frac{(2x+1)dx}{x(x+1)(x+2)}, \quad \int_0^a \frac{(a - x^2)dx}{\sqrt{2(a^2 + x^2)}}, \text{ and } \int \cos^6\theta\, d\theta.$$

9. Find the area of the loops of the curve $x^4 - ax^2y + 4ay^3 = 0$. Find the area between the curve $y^2(x^2 + a^2) = a^2x^2$, and its asymptotes.

10. Find the volume of the solid generated by the revolution of a cycloid about its base.

DEPARTMENT OF PHYSICS AND CHEMISTRY.

ELEMENTARY PHYSICS.

ANNUAL EXAMINATION.

JUNE, 1878.—*Time allowed, five hours.*

1. What are the reasons for selecting mercury as the liquid used in the construction of thermometers?

2. A brass bar measures 1.8 metres at 10° C., when measured by a steel tape; what will it measure by the same tape at 30° C.? Tape and bar are in both cases at the same temperature. Coefficient of expansion of brass, .000018; of steel, .000011.

3. A piece of glass of which the linear expansion from 0° C. to 100° C. is .0009 of its length at 0° C. loses at 0° one gramme of its weight in a fluid in which it is weighed, while at 100° it loses only .96 gramme. Find expansion of fluid from 0° to 100° C.

4. At what two temperatures does a given mass of water have the same volume? In correcting the height of a barometer for temperature, which coefficient of expansion do you use, and why?

5. State the laws of Boyle and Charles. Explain how they furnish the means of determining the volume, temperature, or pressure of a mass of gas when two of these quantities are given.

6. A substance weighs 450 grammes in the air at 15° C., what is its weight *in vacuo*? A litre of dry air at 0° C. weighs 1.293 grammes; specific gravity of the substance 2.2; of the weights 7.8.

7. What influence does pressure have upon melting point of ice? Explain the phenomenon of regelation.

8. A tank 10 metres long and 4.2 metres broad is filled with water at 12°C. to the depth of 1.65 metres. How much steam must be condensed in the water to raise it to 25°? How much will its temperature then be lowered by 250 kilogrammes of ice?

9. Two plane mirrors, placed vertically, are inclined to each other at an angle of 120°; a horizontal straight line is drawn from one mirror to the other, construct the images formed.

10. A reflecting telescope consists of a concave mirror, whose radius of curvature is 2 metres, and an eye-lens of 5 centimetres focal length; distance from mirror to lens 1.15 metres. What will be the size of the image of an object 1 metre high, placed 10 metres from the reflector?

11. A ray of light falls upon one face of a prism, making angle of incidence=40°. Refracting angle of prism 60°. Index of refraction 1.55. What is the angle of emergence?

12. Describe the phenomena which are observed when a ray of white light passes through a prism. What is "angle of minimum deviation"? What is "angle of dispersion"?

CHEMISTRY.

ANNUAL EXAMINATION.

JUNE, 1878.—*Time allowed, five hours.*

1. Find the numerical coefficients in the following reactions: a $H_4N\,Cl$ + b $Ca\,CO_3$ = w $Ca\,Cl_2$ + x H $H_4N\,CO_3$, 2 $H_4N\,CO_2N\,H_2$ + y H_3N + z H_2O.

2. Give the names of the following substances, and state the rules upon which the names are given: $Fe\,Cl_2[Fe_2]\,Cl_6$, H, H_4N, $NaPO_4$, H_2SO_4, H_2SO_3.

3. Write the formulæ and chemical names of the following substances: Arsenic, bleaching-powder, gun-cotton, oil of vitriol, aqua fortis.

4. Describe the manufacture of glycerine and nitro-glycerine.

5. Given the percentage composition of chloroform as follows: C 10.04, HO .83, Cl 89.13: required the formula, knowing that a litre of the vapor under normal conditions weighs 5.3536 grammes.

6. Show the relationship between the members of the chlorine group.

7. By the aid of graphic formulæ, show the relation of picric acid to benzole, tracing each step in the formation.

8. State the source and modes of formation, and means of preventing the formation, of boiler-scale.

9. What two kinds of white paint are in general use? What is the composition of each? What are their relative advantages?

10. Give a description of at least two substances which are used as disinfectants, and show how they act.

DEPARTMENT OF ENGLISH STUDIES, HISTORY, AND LAW.

RHETORIC AND NAVAL HISTORY.

ANNUAL EXAMINATION.

JUNE 12, 1878.—*Time allowed, five hours.*

[Starred (*) questions are alternatives.]

I.—RHETORIC.

1. Name and explain the principal figures of speech.
2. Give the principal rules for the structure of the paragraph.
3. Give Blair's rules for unity.

II.—NAVAL HISTORY.

1. Give an account of the affair of the Chesapeake and Leopard.
2. Name the captains who successively commanded before Tripoli, and give a short account of the command of each.

3. Give an account of the battle of Lake Champlain, with clear plans of the fight, showing position of ships, land, direction of wind, and progress of the engagement.

4. What were the chief points of importance in the battle between the Shannon and Chesapeake?

5. Give an account of Farragut's operations in the Mississippi in the first half of 1862.

5.* Name the men most distinguished in American naval history, and state briefly the important event in the lives of the *three* who rendered most important service.

6. Explain the terms, line-of-battle ship, frigate, sloop of war, two-decker, carronade, long gun. What class of ships now corresponds to the line-of-battle ship of the beginning of the century? to the frigate?

6.* Give a general account of the battle of the Nile. What led to the battle? State the place fought, commanders, approximate force of fleets, results.

7. Give some account of the Confederate steamer Sumter.

7.* When did the ram cease to be used in naval warfare? When was it readopted? When was the torpedo first used effectively? What brought about these changes?

CONSTITUTION.

SEMI-ANNUAL EXAMINATION.

JANUARY 28, 1878.—*Time allowed, five hours.*

1. Define treaty, prorogation and dissolution, law and equity, original and appellate jurisdiction, presentment and indictment, stocks and bonds.

2. Describe the methods by which Congress exercises the power to borrow money, explaining the terms *five-twenties, ten-forties, seven-thirties.* Explain the Refunding Act of July, 1870. What are the advantages of the national bank currency?

3. Enumerate (1) the absolute prohibitions upon the States; (2) those subject to a modification by Congress. To whom do the prohibitions in the bill of rights apply?

4. When was the Navy Department established? When was flogging in the Navy abolished? What is the tenure of office in the Army and Navy? What powers over the militia belong to Congress? what to the States? What is the extent of the power of Congress over places ceded to the general government? (Give Constitutional clause.) What reservation is generally made by the States in these cessions?

5. By whom are the following persons elected or appointed: 1. President. 2. Senators. 3. Judges of the Supreme Court. 4. Presidential Electors. 5. Representatives. 6. Deputy postmasters (under $1,000). 7. President *pro tempore* of the Senate. 8. Senators filling vacancies in recess. 9. Officers filling vacancies during recess of Congress.

6. With whom rests the power to impeach? to try impeachments? to suspend public officers in recess? to expel members of Congress? to remove disabilities from persons formerly in rebellion? to grant pardons? to ratify amendments (two answers)? to suspend the writ of habeas corpus? to originate revenue bills? to call for the yeas and nays? to regulate time, place, and manner of holding elections for Senators? to make treaties?

7. State the extent of the judicial power of the United States, specifying the cases in which the Supreme Court has original jurisdiction. How did the XIth amendment limit the judicial power? Compare the scope of Parliamentary power with that of Congress, and point out the corresponding difference in the judicial power in the United States and Great Britain.

8. Describe briefly the three cases in which laws have been declared unconstitutional. How does the question of the Constitutionality of a law arise in the courts?

9. Enumerate the rights of persons under criminal prosecution. Explain the difference between appeal and writ of error. How does the VIIth amendment limit the process of appeal?

10. What is the Constitutional provision as to the formation and government of new States and Territories? State the extent of the political and civil rights enjoyed by inhabitants of a Territory. Describe the usual form of Territorial government, and the process by which a Territory becomes a State.

DEPARTMENT OF MODERN LANGUAGES.

FRENCH.

ANNUAL EXAMINATION.

JUNE, 1878.—*Translate into French.*

DEPARTURE OF GIL BLAS FOR SALAMANCA.

Previous to my departure, I went to kiss my father and mother, who did not spare me remonstrances. They exhorted me to be grateful towards my uncle, to live as an honest man, and, above all, not to take the goods of others; and they gave me their benediction, which was the only thing that I expected from them. Immediately I mounted my mule, and went out of the town. Behold me then out of Oviedo, on my way to Pegnaflor, master of my actions, a bad mule, forty ducats, and some reals. The first thing I did was to count and count again my ducats in my hat. I could not contain my joy: I had never seen so much money: I could not tire myself in looking at it and handling it. I was counting it perhaps for the twentieth time, when suddenly my mule stopped in the midst of the high road. I judged that something frightened him: I looked, and perceived on the ground a hat overturned; at the same time I heard a lamentable voice, which uttered these words: "Mr. traveller, have pity, I pray, on a poor lame soldier; throw, if you please, some pieces of money into this hat; you will be rewarded for it in the other world." I then turned my eyes on the side whence the voice came: I saw at the foot of a bush a kind of soldier, holding in his hand a musket with which he was taking aim at me. At this sight, which made me tremble, I stopped short: I promptly concealed my ducats, I threw some reals into the hat and had the precaution to throw them one after the other to show the soldier that I acted nobly; he was satisfied with my generosity, and gave me as many blessings as I gave kicks to my mule in order to get quickly away from him, but the cursed animal did not go faster for that: the long habit which he had contracted to walk step by step under my uncle, had made him lose the use of the gallop. I did not draw from this adventure too favorable an omen for my journey. I represented to myself that I was not yet at Salamanca, and that I might indeed meet with some worse accident.

SECOND CLASS.

DEPARTMENT OF SEAMANSHIP.

SEAMANSHIP.

ANNUAL EXAMINATION.

JUNE, 1878.—*Time allowed, five hours.*

1.

What are the duties of the officer of the forecastle? What are the duties of the officer of the gun-deck? What are the duties of the officer of the deck?

2.

State how launches are fitted for weighing anchors. Weigh a bower anchor with a launch fitted with a funnel. Carry out a kedge for warping ship.

3.

Describe the log-line and time-glasses. How is the log-line marked? Describe the different kinds of leads used aboard ship. How are the different lead-lines marked?

4.

Name the different day and night lookouts. State the numerals and symbols used in recording the wind, weather, clouds, &c., in the log-book. What are the terms used in conning ship?

5.

How are bower and sheet chains bent? How are bower and sheet anchors got ready for use? How are bower anchors let go? Describe fittings. How do you sweep for an anchor? How do you know which end of a cable to bend to the anchor?

6.

Describe the manner of measuring for rigging with a fore-and-aft draft and beam scale.

7.

How are yards secured for hoisting heavy weights? Make preparations and hoist out steam launch. Give general rule for the lead of yard and stay falls. Reeve fore and main braces, fore and main topsail braces, and cat-fall (give reasons for reeving the cat-fall as directed).

8.

Describe by diagrams a main-topsail and a spanker. Describe the manner of tossing letting fall, laying on oars, and how oars are held in the different positions.

9.

How do you make preparations for loosing sail to a bowline and how do you loose sails to a bowline? How do you furl sails which are loosed to a bowline?

10.

Give the rules of the road, including lights and fog-signals; use diagrams in explaining the different cases of the former.

NAVAL TACTICS.

ANNUAL EXAMINATION.

JUNE, 1878.—*Time allowed, four hours.*

1.

Draw a diagram of a fleet of twenty-four vessels, *in line, natural order.* Show by means of brackets how it is divided into divisions and squadrons, placing the name of each over its bracket. Show by whom commanded, by placing the number denoting order of rank to the right of the name of division or squadron. State position of *commander-in-chief, division* and *squadron* commanders. Draw diagram of twelve vessels *in column, natural order;* show as above how divided, named, and commanded. State positions of *commander-in-chief,* and *division* commanders. State distance between vessels at *half distance,* in *close order,* and in *open order.*

2.

The fleet being in column of vessels, in natural order, heading north, form it into double columns of vessels, abreast by divisions, heading N.E. ½ N., in natural order. State fully how the courses are signalled.

3.

The fleet being in line, form column of divisions on the centre division, right in front. The fleet being in column of divisions, form line.

4.

The fleet being in columns of vessels abreast by divisions in *natural order*, heading north, form it into column of vessels on the right division, in *natural order*, preserving the original direction.

5.

The fleet being in double column on the centre, heading north, form it into line to the right or left, at right angles to the original direction (three methods).

6.

Draw diagrams of fleet in *double echelon*, in *natural*, in *reverse*, in *inverted*, and in *reverse-inverted* order. What is echelon in bow-and-quarter line, and how formed?

7.

The commander-in-chief signals: "From the vessel whose distinguishing pennant is shown above this signal, form *double-echelon*." N. B.—Distinguishing pennant of No. 13 shown. Re-form the line to the front.

8.

The fleet being in column of vessels by the wind and headed off, restore the order on the same tack. The wind veers, restore the order on the same tack.

DEPARTMENT OF ORDNANCE AND GUNNERY.

INFANTRY TACTICS.

SEMI-ANNUAL EXAMINATION.

FEBRUARY, 1878.—*Time allowed, four hours.*

[Draw diagrams wherever it is necessary to complete the explanation of a movement.]

1. Describe the direct step; state how its principles are taught; describe the march in direct step.

2. Give the position of "carry arms"; describe the execution of the following positions: "Order arms"; "carry arms"; "right-shoulder arms"; "support arms"; "carry arms"; "load in four times"; to "aim"; "right-oblique aim"; "fire kneeling"; "on guard"; "prime parry, thrust."

3. To form the company. After forming the company, post officers and non-commissioned officers, march in column of fours to the front.

4. Being in column of four, form line to the front; to the left; and on the left.

5. Skirmishers. Deploy a company to the front. Deploy by both flanks. A battalion of ten companies being in line at a halt, deploy forward on left of fifth company, using deployment by numbers.

6. Battalion being in line at a halt, advance in line; change direction in line; halt. General alignment. Fire by company. Fire by rank.

7. Being in column of fours, form front into line faced to the rear. A part of the column of fours having changed direction to the right, form line to the left. Being in line, form double column of fours.

8. Being in line at a halt, ploy the battalion into close column on the first division with the first division in front. Being in close column of divisions at a halt, deploy column to the left on the first division. Column of divisions at full distance at a halt, break into column of companies.

9. Describe the review of a battalion, explaining all the movements in detail.

10. Tactical example. A battalion of ten companies, marching in double columns of fours, is delayed by an obstruction. Attacked from the left and front. Left flank is beaten back, requiring change of front. Explain the movements necessary to meet these contingencies, giving diagrams.

GUNNERY.

ANNUAL EXAMINATION.

JUNE, 1878.—*Time allowed, five hours.*

1. Name and define the different parts of the Dahlgren gun. Define calibre.
2. Material of cartridge-bags; define gravimetric density; how fill a charge? how enter it in the bore, and why?
3. Describe the preparation of a spherical shell for service, from leaving inspector's hands until ready for loading.
4. Describe "in-and-out" and "compression" gear of monitor carriages. What are sectional staves? where used, and why?
5. Describe Bormann fuse and how prepared for firing. How do you use shrapnel for canister when the latter is gone?
6. Define *shell*, *shrapnel*, and *canister*, and state the uses of each.
7. What is a *rifled gun?* Define *land*, *groove twist* (uniform and increasing), *drift*. What is the advantage of rifle over spherical projectiles? Directions of drift?
8. Describe a *trunnion square*. What is the use of the *star-gauge?*
9. Describe the sights of 8-in. rifle, 100-pdr. Parrott, and 12-pdr. smooth-bores.
10. Give directions for pointing a gun when the ship is motionless; also when moving rapidly ahead and rolling heavily.
11. Discuss appearance of vent impressions as indicating safety of gun. What is the regulation size of the vent? What is the greatest enlargement allowed?
12. Give the names of the different classes of naval powder (new classification); size of grains in each, and specific gravity of powder.

DEPARTMENT OF ASTRONOMY AND NAVIGATION.

ASTRONOMY.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1878.—*Time allowed, five hours.*

1. On the horizon of a place in latitude 30° N. project stereographically the different circles of the celestial sphere, so as to show the latitude, longitude, right ascension, declination, altitude, azimuth, and hour angle of a heavenly body whose right ascension is 9 hours, the sidereal time being 6 hours. (Draw the primitive circle with a radius of 3 inches.)
2. Explain the index error of a sextant, and give one method of obtaining it.
3. How would you construct a vernier—the arc reading to 8′—so as to read to 16″?
4. A sextant has a negative I. C. of 12′ 15″, and an angle of 32° 12′ 15″ is measured with it, what will be the sextant reading? Also through what arc will the zero of the vernier *actually be moved*, starting from the position of parallelism?
5. January 2, 1878 (civil day), the local apparent time being 6 a. m. in longitude 167° 47′ 15″ east, find the hour angle of the moon?
6. Show how to obtain the parallax in altitude, the horizontal parallax being known. Show how the dip is affected by refraction. What will the magnitude of the dip, the refraction, and the parallax depend upon? (The state of the atmosphere being supposed to remain unchanged.) Give the signs of application to an observed altitude.
7. Describe the methods of the text of obtaining the latitude at sea.
8. Describe the methods of obtaining the longitude at sea. 1st, from Greenwich chronometer; 2d, from a corrected lunar distance.
9. Define the equation of time in terms of hour angle, and of longitude and right ascension. To what two causes is it due?

10. April 18, 1878 (astronomical day), longitude 122° 43′ west: the *true* altitude of ☽ being 17°, at *lower culmination*, what is the latitude?

11. Define the sidereal, tropical, and anomalistic years. State the causes of the differences in their lengths. Which is used in our calendar, and why?

12. Describe briefly precession and aberration.

13. Define the common, and the corrected establishments of a port; neap and spring tides. At which of the latter does the water fall the lowest? What is lagging and when does it occur?

14. Deduce, and explain by a diagram, formulæ for finding the sidereal period of a superior planet from the synodical. How is the latter found?

15. June 30, 1878 (civil day), north latitude, longitude east 120°, find the time of the lower high-water, the corrected establishment being $6^h\ 46^m$.

16. What is a nebula, and what a cluster? What is the annual parallax of a star? How are stars catalogued?

17. Define briefly a comet; a shooting star; a detonating meteor, and an aerolite. What are the minor planets, and where are their orbits?

18. How find the horizontal parallax of the moon and thence its magnitude? In what time does the moon rotate upon its axis?

19. October 6, 1878 (astronomical day), at Annapolis, longitude $5^h\ 05^m\ 56^s.5$ west, the local mean time being $4^h\ 30^m$, how long will it be until the star Altair (R. A. $19^h\ 44^m\ 53^s$) crosses the meridian?

20. December 25, 1878 (astronomical day), longitude 108° 36′ east, when Spica (R. A. $13^h\ 18^m\ 49^s.6$) is on the meridian, the sidereal clock shows $14^h\ 49^m\ 15^s$, what will be the local mean time when the clock shows 15^{hrs}, its rate during the interval being inappreciable?

DEPARTMENT OF PHYSICS AND CHEMISTRY.

ELECTRICITY AND MAGNETISM.

ANNUAL EXAMINATION.

JUNE, 1876.—*Time allowed, five hours.*

1. Explain the distribution of charge upon a body under the influence of induction? Are the density and potential the same at all points?

2. Give an expression which will show the relation between the length, section, and material of a conductor and its electrical resistance. How does temperature influence the resistance of (1) a conductor, (2) a non-conductor, and (3) an electrolyte?

3. Explain the difference between the electro-static and electro-magnetic systems of units.

4. A magnet when freely suspended makes one vibration in 9.18 seconds: the same magnet when placed perpendicular to the meridian, with its centre at a distance of 2.2 feet from a suspended needle, deflects the latter through an angle of 1° 18′.124. What is the value of H., the horizontal intensity of the earth's magnetism? Moment of inertia of magnet, 0.12414.

5. Two small insulated metallic spheres are charged with quantities of electricity in the ratio of 3 to 5, and, when placed at a considerable distance from each other, they repel each other with a certain force. After being made to touch, they are separated to three times the first distance. Compare the force of repulsion which they now exert with that exerted in the first instance.

6. A fixed non-conducting ball is charged with positive electricity and acts by induction on a small metallic ball placed at a considerable distance and slightly charged, also, with positive electricity. When the distance between their centres is 10 c. m. the movable ball is in equilibrium. Taking its radius as 1 c. m., find, approxi-

mately, the ratio of the quantity of electricity developed by induction to the free electricity originally on the ball.

7. A reflecting galvanometer whose resistance was 8,000 ohms, and which had a shunt reducing its sensibility a hundredfold, was joined up with a battery of 30 ohms resistance and a standard resistance of 90 ohms, and the deflection was 72 scale divisions. Find the constant of the unshunted galvanometer; that is, the resistance of the circuit which would give a deflection of one scale division.

8. Twenty-four cells are to be used to work an electro-magnet. The resistance of each cell is .304 ohm; resistance of magnet, .274 ohm; E. M. F. of each cell, one volt. How connect up battery?

9. A wire 2 metres long is moving with a velocity of 100 metres a second in a uniform magnetic field, perpendicularly to itself and the lines of force. What must be the intensity of the field in order to develop an E. M. F. equal to one volt?

10. A submarine cable develops a fault. How is its position determined?

11. Draw diagrams showing instruments and connections at both stations in the duplex systems of telegraphy.

12. A tangent galvanometer and voltameter are placed in the same circuit; the deflection is 41°; oxygen and hydrogen liberated per minute 74.5 $\overline{\text{c. m.}}^3$ If same galvanometer be included in a circuit with a saturated solution of $Cu\,SO_4$, and the deflection be 10°, how much copper will be deposited in 24 hours?

DEPARTMENT OF MECHANICS AND APPLIED MATHEMATICS.

CALCULUS.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1878.—*Time allowed, five hours.*

[Nine questions required.]

1. Given $\dfrac{\frac{\phi(x)}{x}}{\varepsilon} = \dfrac{\frac{\phi(z)}{z}}{\varepsilon}$, and $\phi(\varepsilon) = \varepsilon$, to determine the function ϕ. Deduce the differential of $\log x$.

2. Given $y = \log \dfrac{(x-1)^2}{x^2+x+1} - \sqrt{3}\tan^{-1}\dfrac{2x+1}{\sqrt{3}}$, find $\dfrac{dy}{dx}$.

Given $y = \dfrac{\varepsilon^{x\sqrt{x^2-1}}}{x+\sqrt{x^2-1}}$, find $\dfrac{dy}{dx}$.

3. Prove that of all circular sectors of the same perimeter, the sector of greatest area is that in which the circular arc is double the radius. Trace the curve $r = 2a\cos\theta\cos 2\theta$, determining the maxima values of r.

4. If $x = \tan(x+y)$ expand y in powers of x to the term containing x^7, inclusive. Expand $\log(1+\varepsilon^x)$ in powers of x to the term containing x^4 inclusive.

5. Trace the curve $r = a\dfrac{2\theta}{2\theta-1}$; find the rectilinear and the circular asymptote. Trace the curve $(y^2-b^2)^2 = a^2x$; find the points of inflexion.

6. Find the perpendicular from the origin on the tangent of the four-cusped hypocycloid. Find the subtangent and the point of inflexion of the lituus $r^2\theta = a^2$.

7. Find the equation of the evolute to the tractrix

$$x = a\log\frac{a+\sqrt{a^2-y^2}}{y} - \sqrt{a^2-y^2}.$$

Find the radius of curvature of the lemniscata $r^2 = a^2\cos 2\theta$.

8. Find $\int \sqrt{\sin\theta}\cos^3\theta\,d\theta$, $\int \dfrac{\cos x\,dx}{\sec x+\tan x}$, and $\int \dfrac{dx}{(x-1)^2(x^2+1)^2}$.

9. Find the area of the loop of the curve $a^3y^2 = x^4(b + x)$; or find the whole area of the curve $\left(\frac{x}{a}\right)^{\frac{2}{3}} + \left(\frac{y}{b}\right)^{\frac{2}{3}} = 1$. Find the length of an arc of the semi-cubical parabola $ay^2 = x^3$.

10. Find the volume generated by the revolution of the tractrix about the axis of x. Derive the formula for determining areas by means of Amsler's planimeter.

11. Find the evolute of the curve $\begin{cases} x = \frac{5}{2}\sin\theta - \sin^3\theta, \\ y = -\frac{1}{2}\cos\theta + \cos^3\theta. \end{cases}$

Trace the curve $2x^3 - 4x^2y + 2xy^2 - 6x^2 + 6y^2 + 16y = 0$.

MECHANICS.

ANNUAL EXAMINATION.

JUNE, 1878.—*Time allowed, five hours.*

1. A solid is formed by the revolution about the axis of X, of the curve $a^2y = ax^2 - x^3$; find the centre of gravity of the portion between the limits $x = a$ and $x = 0$. A right cone is divided into two equal parts by a plane containing the axis; find the co-ordinates of the centre of gravity of one of the parts.

2. Two small rings slide on a smooth vertical hoop; a cord passing through the rings sustains three equal weights, one on the bight between the rings, and one at each end: find the position of equilibrium.

Or—

2. A string, A B C D E P, is attached to the centre, A, of a pulley, the radius of which is r; it then passes over a fixed point, B, and under the pulley, which it touches in the points C and D; it afterwards passes over a fixed point, E, and has a weight, P, attached to its extremity; B E is horizontal and equal to $\frac{5}{3}r$, and D E is vertical: supposing the system to be in equilibrium, find the weight of the pulley and the distance A B.

3. A uniform chain, l feet in length, hangs over two smooth pegs in the same horizontal plane $2a$ feet apart, the ends of the chain being in a horizontal line 2 feet below the lowest point of the bight; derive the equation to the curve of the bight, and prove that the tension at any point of this curve is equal to the tension at the lowest point plus the weight of a portion of the chain, whose length equals the ordinate at that point, the lowest point of the curve being the origin; find also the length of the part of the chain between the two pegs.

4. A weight, W, is held on a rough inclined plane by friction and a cord lying on the plane, the coefficient of friction being unity, and the breaking strain of the cord $\frac{W}{\sqrt{2}}$ determine the inclination of the plane when the cord is on the point of breaking.

Or—

4. A weight of 2,000 pounds is to be lowered into the hold of a ship by means of a rope which passes over a spar lashed across the hatch coamings; the arc of contact between the rope and spar being $1\frac{1}{4}$ circumferences, and the coefficient of friction $\frac{7}{22}$, determine the force which a man must exert at the end of the rope to control the weight.

5. Compare the work accumulated in a ship weighing 2,000 tons, and moving at a speed of $7\frac{1}{2}$ miles per hour, and that accumulated in a shot weighing 400 pounds, and moving with a volicity of 1,500 feet per second. A body is projected up a smooth inclined plane of height h; when half way up the plane the force of gravity is doubled, and the body barely reaches the top of the plane; required, the velocity of projection.

6. A ball whose elasticity is e is projected from a given point in a circular hoop, and after two reflections returns to the given point; determine the direction of projection. A shot is fired with a velocity of 400 feet, at an elevation of 30°, and is observed to strike an object at the end of 4 seconds; find the inclination of the line which joins the object and the gun.

7. Find the radius of gyration of a right pyramid about its axis. Determine the ratio of the diameter of the base to the altitude of a cone, so that the centre of oscillation when the cone is suspended by the vertex may be at the centre of the base.

8. Find the horse-power of an engine that raises a tilt-hammer, weighing $1\frac{1}{2}$ tons, 25 times a minute, the lift being 2 feet. The number of vibrations made in a certain time by a pendulum at the surface of the sea was 20,000, and the number made in the same time by the same pendulum at a height of 10,530 feet was 19,990; find the radius of the earth.

9. A circle whose radius is a is immersed in a fluid; find the centre of fluid pressure, b denoting the distance of the centre of the circle below the surface of the fluid. A paraboloid of revolution, formed of solid oak, floats in water with its axis vertical and vertex downward; find the depth of flotation, the length of the axis being 3 feet, the radius of the base 2 feet, and the weight of a cubic foot of oak 54 pounds.

10. A vessel in the form of an ellipsoid of revolution is filled with fluid; find the time in which the fluid will flow out through a small orifice at the lower extremity of the axis of revolution, which is vertical and equal to $2a$. A cylindrical diving-bell 10 feet high is sunk until its top is 18 feet below the surface of the water; if the pressure of the atmosphere is 15.625 pounds to the square inch, find the height of the water in the bell.

Extra question.

11. Find the time of emptying a vessel formed by the revolution of a given cycloid about its axis, the orifice being at the vertex and the axis vertical.

An inclined plane, l feet in length, makes an angle of 30° with the inelastic horizontal plane on which it rests; two equal weights, connected by an inextensible cord passing over a pulley at the top of the plane, rest one at the top of the inclined plane, and the other on the horizontal plane vertically below it; the cord is of such a length that when the former is allowed to fall down the plane the impulse is just sufficient to permit it to reach the bottom; if the weights continue to oscillate, find the time before they come to rest.

DIFFERENTIAL AND INTEGRAL CALCULUS.

SEMI-ANNUAL EXAMINATION.

ELECTIVE COURSE.

JANUARY, 1878.—*Time allowed, five hours.*

Cadet-Midshipmen R. H. Miner, J. Hood, H. Wike, A. B. Clements, E. E. Hayden, and H. S. Chase.

Cadet-Engineers W. M. McFarland, R. Gatewood, F. T. Bowles, B. J. Bryan, and C. B Lubbe.

Given $\int_0^\infty \frac{x^{a-1}dx}{1+x} = \frac{\pi}{\sin a\pi} = \Gamma(a)\Gamma(1-a)$, $\int_0^\infty \frac{x^{a-1}dx}{1-x} = \pi \cot a\pi$,

and $$\int_0^{\frac{\pi}{2}} \sin^{p-1}\theta \cos^{q-1}\theta d\theta = \frac{\Gamma\left(\frac{p}{2}\right)\Gamma\left(\frac{q}{2}\right)}{2\Gamma\left(\frac{p+q}{2}\right)}.$$

1. Find the value of $\int \frac{1-x^2}{1+x^2} \cdot \frac{dx}{\sqrt{1+x^4}}$, and of $\int \left(\frac{1-x}{1+x^2}\right)^2 \epsilon^x dx$.

2. Find the value of $\int_0^1 \frac{x^2dx}{\sqrt{1-x^4}} \times \int_0^1 \frac{dx}{\sqrt{1+x^4}}$, and of $\int_0^1 \frac{dx}{(1-x^4)^{\frac{1}{4}}}$.

3. Prove De Moivre's theorem, by means of $\int \frac{dx}{1-x^2}$ and $\int \frac{dx}{1+x^2}$. Find the value of $\int_0^x \varepsilon^{-x^2} dx$.

4. Find the value of $\int_0^\infty \frac{x^a \log x \, dx}{1+x^2}$. Prove that $B(m, n) = \frac{\Gamma(m)\,\Gamma(n)}{\Gamma(m+n)}$.

5. Find the value of $\Gamma\left(\frac{1}{n}\right)\ \Gamma\left(\frac{2}{n}\right) \ldots\ldots \Gamma\left(\frac{n-1}{n}\right)$. Find the area enclosed between the two loops of the Limaçon, $r = 2a\cos\theta \pm a$.

6. Find the whole area of the curve $\left(\frac{x}{a}\right)^{\frac{2}{3}} + \left(\frac{y}{b}\right)^{\frac{2}{3}} = 1$. Prove the formula, $\frac{1}{2}\int r^2 d\theta = \frac{1}{2}\int x^2 dm$, and thence derive an expression in gamma-functions for the area of the loop of the curve, $x^5 + y^5 - 5ax^3y = 0$.

7. Find the length of the curve of double curvature

$$y = \frac{a}{2}\left(\varepsilon^{\frac{x}{a}} + \varepsilon^{-\frac{x}{a}}\right), \quad z = \frac{1}{8}\left[y\left(\varepsilon^{\frac{x}{a}} - \varepsilon^{-\frac{x}{a}}\right) - 2x\right].$$

8. Find approximately, by means of gamma-functions, the length of a loop of the curve $r^{\frac{4}{7}} = a^{\frac{4}{7}}\cos\tfrac{4}{7}\theta$. Find the length of the curve, $x = 4\sin\phi - \sin^3\phi$ and $y = \cos\phi + \cos^3\phi$, between the limits $\phi = 0$ and $\phi = \frac{\pi}{2}$.

9. The axis of a right cylinder whose base is the curve $r = a\cos 3\theta$ passes through the centre of a sphere of radius a; find the volume enclosed between the convex surface of the cylinder and the concave surface of the sphere. Find a general expression for the volume generated by the revolution of a circular segment about its chord.

10. Trace the curve $y = \frac{x\left(1 - 3\varepsilon^{\frac{1}{x}}\right)}{1 + \varepsilon^{\frac{1}{x}}}$, also the curve $y = x\,\varepsilon^{-\frac{\sin a}{2}\left(x - \frac{1}{x}\right)}$, finding the maximum and minimum ordinates.

11. The axis of a right cone coincides with the generating line of a cylinder; the diameter of both cone and cylinder is equal to the common altitude: find the volume and surface of each of the parts into which the cone is divided by the cylinder.

ELECTIVE MECHANICS.

ANNUAL EXAMINATION.

JUNE, 1878.—*Time allowed, five hours.*

Cadet-Midshipmen R. H. Miner, A. B. Clements, J. Hood, E. E. Hayden, H. Wike, H. S. Chase, J. B. Blish, and C. W. Jungen.

Cadet-Engineers W. M. McFarland, F. T. Bowles, R. Gatewood, and B. J. Bryan.

1. A paraboloid of revolution (altitude a) rests on a horizontal plane; determine its position of equilibrium, the generating curve being $y^2 = 4mx$. Find the value of m in terms of a when the solid rests in stable equilibrium on its apex.

2. A cord suspended from two given points has the area of its transverse section proportional to the tension at every point; find the equation to the curve in which it hangs. A perfectly flexible smooth cord hangs over a horizontal peg; find the time required for it to slide off, supposing the centre of the cord to rest on the peg when it receives an impulse giving it an initial velocity of 32 feet per second.

3. A body is situated at the distance a from the centre of an attractive force which varies inversely as the nine-elevenths power of the distance; find the time required for the body to fall to the centre of force. Find the time when the force varies inversely as the distance.

4. The resistance of air being proportional to the square of the velocity, determine the time required for a body projected vertically upward to return to the point of starting; determine also the velocity at any point.

5. A particle is placed on the concave surface of a smooth sphere and acted upon by gravity, and also by a repulsive force which varies inversely as the square of the distance, and has its centre at the lowest point of the sphere; find the position of equilibrium of the particle.

6. Find the relation between the moments of inertia of a plane surface with reference to two different pairs of rectangular axes, the origin being the same. Find the polar moment of inertia of a regular hexagon.

7. A particle is projected from a given point in a given direction with a given velocity, and moves under the action of a force which varies inversely as the square of the distance from the centre; required, the orbit. If the force varies directly as the distance and is attractive, determine the orbit.

8. A particle is placed in a smooth tube which revolves horizontally about an axis through one end of it; required, the equation of the curve traced by the particle. A homogeneous prismatic bar A B in a horizontal position, and constrained to revolve about a fixed vertical axis A, receives a direct impulse from a sphere whose momentum is Mv; required, the angular velocity of the bar.

9. A sphere C of radius 3 feet and weight 500 pounds is put in motion by a weight P of 20 pounds by means of a string going over a wheel whose radius is 6 inches; in what time will P descend through 50 feet, and what velocity will it then have acquired? A homogeneous hollow cylinder rolls down an inclined plane by the force of gravity; required, the time.

10. A paraboloid whose weight W is 200 pounds and radius of base 20 inches is made to revolve about its axis, which is horizontal, by means of a weight P of 15 pounds, acting by a cord that passes over a wheel of one foot diameter on the same axis; after P has descended for 10 seconds it is removed and the paraboloid is left to revolve uniformly with the velocity acquired; find the velocity of the centre of gyration of the paraboloid and the number of revolutions it will make in one minute.

Regarding the earth as a homogeneous sphere, determine the momentum and the point of application of a blow sufficient to give it the angular velocity and velocity in its orbit it now has.

DEPARTMENT OF MODERN LANGUAGES.

ANNUAL EXAMINATION.

JUNE, 1878.—*Translate into Spanish.*

HÉROÏSME.

Un capitaine hollandais, nommé Schaffelar, occupait la forteresse de Barnevelt. On l'assiégea et on le somma de se rendre, mais il ne voulut capituler que lorsque la brèche fut faite.

Le premier article de la capitulation exigeait que le capitaine fut jeté du haut de la tour. Cette condition excita l'indignation des assiégés, qui jurèrent tous de mourir avant qu'ils ne consentissent à une telle demande. Mais le généreux Schaffelar grimpa à la position indiquée et dit: "Mes amis, il faut que je meure un jour et je n'aurai jamais une occasion de mourir plus glorieusement, parceque je sauve mes camarades par ma mort."

Ayant dit ces mots, il se précipita du haut de la tour.

FIRST CLASS.

DEPARTMENT OF SEAMANSHIP.

PRACTICAL SEAMANSHIP.

ANNUAL EXAMINATION.

JUNE, 1878.—*Time allowed, five hours.*

1.

Your ship (sailing) having been in port a month, get her ready for sea in all respects.

2.

Tide rode, with wind two points on the starboard bow, get underway. Cast to starboard and stand out on a wind.

3.

How handle boats in a surf, going to and returning from the shore, under oars or sails? How land on a flat beach? How land on a steep-to beach? Where are weights carried in boats? How take people from a stranded wreck?

4.

Make preparations for a gale at sea. How is a close-reefed topsail set (blowing hard)? How take in a mainsail (fresh breeze)? How hoist a jib (fresh breeze)? How set a main-trysail (blowing hard)?

5.

Weather main topsail sheet and clewline carried away. What is to be done? On a wind, main topmast stay carried away. What is to be done? Weather wheel-rope carried away. What is to be done?

6.

Make preparations for entering port on striking soundings. By the wind, all plain sail set, get a cast of the lead in about thirty fathoms of water.

7.

Your ship (sailing) entering port, moor ship in seven fathoms of water with forty-five fathoms on each chain; prevailing wind from the north.

8.

Ship moored in a tide-way, with an elbow in the hawse. Make preparations and clear hawse. State how the mooring swivel is put on.

9.

What are the boat salutes of all grades of officers, both under oars and sails and when boats are loaded?

10.

What are the indications of a cyclone? Give the geographical limits in both the Atlantic and Indian Oceans and the seasons of cyclones in each. How manœuvre in a cyclone in the Northern Hemisphere? How in the Southern?

NAVAL ARCHITECTURE.

SEMI-ANNUAL EXAMINATION.

FEBRUARY 1, 1878.—*Time allowed, five hours.*

1.

Define meta-centre, and distinguish between the fixed and shifting meta-centre. Deduce the formula for transverse meta-centre height. How find the point of intersection of the upright and inclined water-lines?

2.

Define statical stability. Deduce the formula for statical stability, and explain the terms of the second member of the equation. Show what effect a change in the posi-

tion of the centre of gravity of the ship has upon the statical stability. Define dynamical stability. Deduce the formula for dynamical stability, and explain the terms of the second member of the equation.

3.

Construct and fully explain a curve of stability. This includes wind curve, safe angle of heel, rolling limits, &c.

4.

Deduce the formula for time of ship's unresisted rolling and discuss the formula, showing how it is modified by the conditions encountered by a ship rolling in sea waves. State how rolling may be controlled to some extent by stowage. Distinguish between a stiff ship and a steady one. Give best conditions for a steady gun-platform.

5.

Design.—What constitutes design? What considerations govern design? What are the qualities to be sought for in a design? What is the quality of "working well" in a vessel propelled by sail? In one propelled by steam? Define the terms "entrance," "run," "middle body".

6.

Discuss the advantages of the "wave-line theory of construction." State the principles upon which the theory rests. What decides the length of entrance? of run? What governs the length of middle body? How are water-lines for "entrance" constructed? How are water-lines for "run" constructed? Name, place, construct, and give value of other lines governing form of after-body.

7.

Resistance to ship's motion through the water? Resistance due to frictional eddies? Define augmented surface, and show how it is computed. How compute probable resistance? How compute engine power for given speed? How compute probable speed with given power? Define coefficient of propulsion.

SHIP BUILDING.

SEMI-ANNUAL EXAMINATION.

JANUARY 29, 1878.—*Time allowed, five hours.*

WOODEN SHIP BUILDING.

1.

Give the order in which the work performed in building a ship is executed; the order in which the different timbers composing a ship are put together. (Explanation of the manner of doing the work is not required.) What is a "room and space" batton? When and how used? What is a cutting-down staff?

2.

Make a sketch of a transverse section, showing all timbers cut by the midship section. State when the thick strakes of the outside and inside planking are worked, and explain the method of working them. When frames are first erected how are they retained in position? What are "ribbons," and when are they erected?

3.

Build the midship frame of a vessel; name the different parts composing it—1st, when long and short arm floor timbers are used; 2d, when first futocks are used: explain how the different parts of the frame are secured together. Erect and regulate a midship frame; how is it marked?

4.

For what purpose is the main keelson worked? What fastenings are driven through it? When sister keelsons are worked, where do they terminate, and how are they fastened? What are filling timbers or frames, and how are they worked?

5.

Name all the different timbers that are worked to prevent the two sides of the vessel being forced together or forced apart, and state when each is worked. What is the throating line? Bearding line? Cutting-down line?

6.

How would you measure for the length of a gun-deck beam? Describe fully how the beam is secured in position. What is the shape of a beam, and why is it of this shape?

7.

At what point in the construction of a ship is she regulated? When may a ship be said to be regulated? What are chocks, and how are they worked?

IRON SHIP BUILDING.

8.

Name and describe the different systems of framing used in iron ship building. What kind of keel is in general use with each system? Describe the *bar* keel, and state how it is connected to the remainder of the hull.

9.

Describe the method of working keels and keelsons of an iron-clad man-of-war. Show how the garboard strakes are united to the keel. What care is to be taken in working these different parts of the ship?

10.

Make a sketch of the stem of an armor-clad vessel, and describe it. When in two or more parts, show how the parts are united, and how the stem is joined to the keel.

11.

How are the frames behind the armor spaced, and how worked? How work platings, girders, and backing behind armor? How work armor and armor-shelf? Describe armor bolts, and the method of testing them.

12.

What are "sheer strakes," and describe how worked? What are "deck stringers," and how are they worked? What are "hold stringers," and how are they worked?

13.

Make a sketch showing the different methods of working outside plating, and describe each method. Make a sketch showing the different systems of riveting. What is the "pitch" of rivets for water-tight work? in the frames? in other work?

14.

How frame and work a water-tight transverse bulkhead? How are "liners" to be worked at water-tight bulkheads?

DEPARTMENT OF ORDNANCE AND GUNNERY.

ORDNANCE AND ARMOR.

ANNUAL EXAMINATION.

JUNE, 1878.—*Time allowed, five hours.*

1. What metals and alloys are in common use for making cannon? Give general qualities of each, stating how they affect fitness for making cannon.

2. Name and describe the two general principles upon which *built-up* guns are constructed, and give an example of each.

3. Give arguments for and against breech and muzzle loading guns for naval use.

4. Describe (in general terms) the breech-loading system adopted in the United States Navy.

5. Describe in detail the 8-inch (converted) rifle-gun now issued to the service (not the process of manufacture, but the gun itself as it stands).

6. Describe the action of the locks in the Gatling gun.

7. Define "system of rifling." Name the systems actually in use in the United States Navy, and describe the application of each system to existing service projectiles.

8. Define *gunpowder*. Give names and proportions of constituents, use of each constituent, and effect of varying proportions. The ingredients being prepared, name in their order the successive steps in the manufacture of gunpowder, stating briefly the object of each, but not entering into the details of the processes.

9. Describe the phenomena of explosion; effect of size of grains upon strain. Define *density;* effect of variations of density. How best obtain uniform density in powders issued to the service.

10. Give general directions for preparing and executing a landing in the face of an enemy.

DEPARTMENT OF STEAM-ENGINEERING.

MARINE ENGINES.

ANNUAL EXAMINATION.

JUNE, 1878.—*Time allowed, five hours.*

[Ten solutions required.]

1. Sketch and describe the Mayer valve.

2. Given one pound of carbon, thermal value 14,500, what will be the maximum temperatures of the furnace when burned with 12, 18, and 24 pounds of air.

3. Given one pound of good coal, liberating by its combustion 14,500 units of heat, which is done with 25 pounds of air: Required the heat available for the generation of steam, the furnace gases being discharged at 600° Fah., temperature of air 50° Fah.

4. Required the number of pounds of water evaporated per pound of coal per hour, from the following data, viz: Diameter of piston 40″, stroke 3′, clearance 12 per cent. of space displacement, steam pressure per gauge 35 pounds, cut-off at $\frac{1}{4}$ stroke, revolutions per minute 50, coal consumed per hour 1,500 pounds. Relative volume of steam 1,530, temperature of steam 283.2° Fah., temperature of feed-water 110° Fah., density of feed $\frac{1}{8}$, density maintained 2.

5. Compute the total horse-power from the following data, viz: Mean effective pressure 30 pounds, vacuum 26 inches, stroke 5 feet, diameter 50 inches, number of revolutions per minute 100, ratio of expansion 2. ($\text{Log}_\epsilon 2 = 0.693$) Give the initial pressure per gauge.

6. Sketch a locomotive slide-valve. Mark upon it the points at which the several functions are performed, naming them. Illustrate its action by a diagram upon which the above points are designated.

7. Sketch and describe a Bourdon pressure gauge, a mercury syphon gauge.

8. Describe a compound engine; state the advantages and disadvantages of jacketing, first, the H. P. cylinder; second, the L. P. cylinder; third, both cylinders.

9. Required the diameters of both the H. P. and L. P. cylinders of a compound engine, from the following data, viz: Indicated H. P. 500, mean effective pressure 25 pounds, length of stroke 3 feet, number of revolutions per minute 60, ratio of expansion 9.

10. Explain the method of combining indicator diagrams of compound engines, and of drawing in the theoretical expansion curve for scientific investigation.

11. How are the moving parts of an engine counterbalanced?

DEPARTMENT OF ASTRONOMY AND NAVIGATION.

NAVIGATION.

SEMI-ANNUAL EXAMINATIONS.

JANUARY, 1878.—*Time allowed, five hours.*

[Questions marked thus * are required.]

1. * What application is made of the problems of plane, parallel, traverse, and middle latitude sailing, in an ordinary day's work or dead reckoning at sea?

2. * How is the Mercator's course between two positions found by inspection? How thence is the distance found?

3. Deduce the formulæ for finding the Great Circle course and distance between two positions.

4. How will you determine the advisability of pursuing the Great Circle route between two places?

5. * Define refraction, dip, and parallax. Illustrate by diagrams and give the sign of application of each to an observed altitude.

6. * How is the parallax in altitude found, the horizontal parallax being known?

7. * Give one method complete for the conversion of local sidereal time to local mean time.

8. Solve the astronomical triangle for h and Z. given t, d, and L.

9. Given L and d, how is the actual time of sunset and sunrise found? (Disappearance of the sun's upper limb below the horizon.)

10. * Deduce the formulæ for finding the latitude by an altitude at any time (ϕ', ϕ'' method).

11. What are ϕ' and ϕ'' respectively? How are they marked? and why?

12. A meridian altitude of the sun not being attainable, how may the latitude be found by an altitude out of the meridian by some other method than that given in (10)? Deduce the formulæ.

13.* Deduce the equation of equal altitudes.

14.* Apply this to finding the chronometer correction: give the details of the various steps, with the reason therefor.

15. What is a circle of equal altitude? Illustrate by a figure. What is a line of position?

16. Give the method of determining the position of a vessel at sea by means of two lines of position, the observations being taken at different times, and the ship not being stationary.

17. What determines the angle between the two lines of position? What would be the most favorable condition that could be selected to obtain the absolute position of a ship at any given instant?

18. For what purposes are lunars useful? How much reliance can be placed upon them? In the direct trigonometrical method, what quantities are required? How are they obtained? Draw a figure explaining the different points of the triangle.

19. How is a Mercator's chart constructed? How are the course and distance between two points on the chart obtained?

20. Deduce the expression for the change in t due to a change in h, and apply this to finding L (Prestel's method).

EXTRAS AND ALTERNATES.

1. Deduce the formula for the meridional parts of the spheroid, having given—

$$r = \frac{a \cos L}{(1 - e^2 \sin^2 L)^{\frac{1}{2}}}, \quad R = \frac{a(1 - e^2)}{(1 - e^2 \sin^2 L)^{\frac{3}{2}}}.$$

2. Deduce the expression for the change in L due to a change in d.

3. Deduce the expression for the change in L due to a change in t.

4. Deduce the formulæ for obtaining the astronomical bearing of a terrestrial object, the angle being measured with a sextant.

5. Deduce the formulæ of Bowditch's first method for finding the latitude by two altitudes of a heavenly body.

THEORY AND PRACTICE OF NAVIGATION AND SURVEYING.

ANNUAL EXAMINATION.

JUNE, 1878.—*Time allowed, five hours.*

1. How are the levels of a theodolite adjusted? How is the axis of collimation caused to coincide with the line of sight and to move in a vertical plane?

2. In the construction of a chart of a harbor, how is a scale of $\frac{1}{5000}$ made? How are the principal stations plotted? How is the shore-line run in? How are the soundings plotted?

3. Give the method of constructing a Mercator's chart. [Latitude 55° to 60° N.; the space between limiting parallels to be 15 inches; and the chart to include 6° of longitude.] Give the method of constructing a polyconic chart. [Scale $\frac{1}{5000000}$; to include 6° of longitude and the same latitudes as above.]

4. To what plane are all soundings reduced? How is the position of this plane determined? What is a bench mark? What is its use? How is it connected with the plane of reference?

5. In the running survey, what is the final base line? When the position by triangulation does not coincide with that by observation, how is it corrected? Explain this by a diagram. What is the most accurate method of fixing the ship's position, and thence the location of new points as they come in sight?

6. What is the variation of the compass? What is the deviation? How are they named? How are they applied, first, to compass courses, second, to true courses?

7. How is a deviation table formed? [State all the methods you know, except that of co-efficients.] How is a Napier's curve constructed, and how is it used?

8. What are the different causes of the deviation of the compass in an iron ship? How is the deviation table constructed by the method of coefficients, knowing the deviation on the eight principal points. How is this deviation table corrected practically for a change in the magnetic latitude?

9. Which two coefficients change with a change of the magnetic latitude? Explain how the two causes of this change have varying effects. How is a compass compensated?

10. What is the heeling error, and how is it caused? What is the heeling coefficient, and how does it vary with a change of the magnetic latitude? How is the change in deviation owing to the heeling error found for any point of the compass? How is a compass compensated for the heeling error?

PRACTICAL WORK.

ANNUAL EXAMINATION.

JUNE, 1878.—*Time allowed, five hours.*

The cadets reported at the observatory at 8 a. m., and took altitutes of the sun, with the sextant and the artificial horizon for a chronometer correction, at the same time taking bearings of the sun with an azimuth compass which had been deflected by a magnet, for the compass error.

Immediately afterward they took an astronomical bearing of the chimney of a house on the north side of the Severn, the observers standing in a line near the observatory. Each cadet was then required to work out his own observations.

DEPARTMENT OF PHYSICS AND CHEMISTRY.

HEAT AND LIGHT.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1878.—*Time allowed, five hours.*

1. The length of a rod measured by a brass standard yard at 75° Fah. is 32 inches. What will be its length in millimetres when measured by a platinum standard metre at same temperature, the coefficient of expansion of brass being 0.000018 for 1° C. and that of platinum 0.000009?

2. Describe the observations and indicate the computations necessary for determining the specific gravity of a vapor by Dumas's method.

3. What will be the weight of five litres of moist air at 20° C., barometer 750 millimetres, where the relative humidity is .35? Tension of saturated aqueous vapor at 20° C. is 17.4 millimetres.

4. Explain the different methods of measuring quantities of heat.

5. Ten grammes of molten tin at 245° C. are thrown into 20 grammes of water at 20° C and raise the temperature of the water to 33°.8 C. Specific heat of tin as solid, .056; as liquid, .064; melting point, 233° C. Determine latent heat of tin.

6. What are the distinctive characteristics of the spectra of solids and vapors? What relation exists between the radiating and absorbing powers of vapors, and how does this explain the presence of dark lines in the solar spectrum?

7. Determine the mechanical equivalent of heat by the method of Mayer? How was Mayer's reasoning perfected by Joule?

8. State the theory of "Conservation of Energy," and that of "Dissipation of Energy." Give the evidence in favor of each.

9. Deduce the probable form of Carnot's function. Show that 0° of absolute scale is the lowest possible temperature.

10. Deduce the expression for the velocity of sound in air. $V^2 = \gamma E_\vartheta v$.

11. (Extra.) Deduce Apjohn's formula $f'' = f' - \frac{d}{87} \times \frac{h}{30}$.

DEPARTMENT OF ENGLISH STUDIES, HISTORY, AND LAW.

LAW.

ANNUAL EXAMINATION.

JUNE 7, 1878.—*Time allowed, five hours.*

1. Explain the difference between a domiciled foreigner and a naturalized foreigner. What facts constitute domicile? State the chief rules for determining domicile.

2. Describe the privileges or immunities of ambassadors, (1) as to their own persons; (2) as to the persons of others; (3) as to their houses; (4) as to their general jurisdiction; (5) as to their criminal jurisdiction.

3. In the case of an internal war or rebellion, what two courses may be followed by the government in its treatment of the insurgents, and how is each policy to be enforced? How are neutrals affected by the attitude of the government of the state in which the revolt occurs, and what rules govern their conduct?

4. State and define the points involved in the case of the Alabama, and give a brie history of the settlement of the question.

5. Define contraband, as understood by the best authorities. What is the penalty of engaging in contraband trade? What is pre-emption, and how is the practice applied? Give a comprehensive statement in regard to the carrying of enemy's dispatches.

6. What is a blockade by notification? What a *de facto* blockade? In what does due notice of a blockade consist? At the beginning of a blockade, how are neutral vessels lading in the enemy's ports affected? Give the four rules of the treaty of Paris of 1856, and define the position taken by the United States in regard to them.

7. Define *jus postliminii*. What is the limit of place within which this right takes effect? What is the limit of time? What is the practice of nations in regard to the admission of belligerent cruisers into neutral ports? Of cruisers with their prizes? If a prize is taken in neutral waters, where may the owner seek redress?

8. War between the United States and France. In command of the United States steamship Hartford, cruising in the Atlantic, you capture the bark Murillo, bound from Barcelona to Brest, with a cargo consisting largely of contraband of war. You send her into port and she is condemned on that ground. She was originally an American vessel, but was captured early in the war, condemned, and sold to a Spanish firm. The original owner puts in a claim. How will it be decided?

Next day you fall in with the Caledonia, an English vessel, bound for Brest, with some eighty men, French officers and seamen, the crew of a French gunboat; the contract was concealed or destroyed, but the vessel has no cargo, and was to have been paid by the French Government; you send her into port. Results?

Soon after, the Alert, an English vessel, bound from Malta to Portsmouth, England, is captured on the 4th of April by the blockading squadron off Bordeaux, while trying to enter that port; the master says that he was short of water and that the crew insisted on entering a French port. It is shown that he passed Lisbon, an open port, on the 2d of April, and neglected to enter, and that he knew Bordeaux was blockaded. Results?

9. A few days later you chase a French privateer, and capture her at the entrance of the harbor of Vigo, a Spanish port. What results will flow from your action? Steering to the northward, you meet the Columbia, an American vessel, bound to New York, in ballast, under a license from the French Government. She had sailed for Havre before the war, and there took on board a cargo of silk and oil for Stockholm. There she received news of the war, and sailed to Cherbourg with a cargo of naval stores. What will you do, and what will be the result? Entering the English Channel, you meet a fleet of Swedish merchantmen under convoy of a Swedish man-of-war of force superior to the Hartford; the man-of-war threatens resistance if search is made. During the night you succeed in detaching a couple of the merchantmen and send them into port. What will be the result as to vessels and cargo?

10. You are ordered to cruise in southern waters, and on your way you meet the Venus, bound from Martinique to France, with a cargo of sugar, the produce of an estate in the island. The owners are citizens of England, and they claim the cargo on the ground that it is neutral property, the owners of the estate being Englishmen. Results? Later on, you capture the Diligentia, bound from Rio to Bordeaux with a cargo of coffee, the property of J. & J. W. Madrazo, of New Orleans and Rio. One member of the firm is a domiciled American, the other a native Brazilian. The vessel is owned in Rio. What will be the result as to vessel and cargo? While cruising in the South Atlantic, a treaty of peace made; but thirty days are allowed from the date of ratification, July 1, for captures made in that part of the world. You capture the Louis on the 10th of July, and send her home for adjudication. She is recaptured on the 5th of August by a French man-of-war. Results?

DEPARTMENT OF MODERN LANGUAGES.

ANNUAL EXAMINATION.

SPANISH.

JUNE, 1878.—*Translate into English.*

Señores CADETES DE LA CLASE PRIMERA: Vuestro estudio en la Academia ha concluido, y el prático de vuestra profesion va á comenzar. En el espacio de dos años, durante los cuales visitaréis diferentes paises, surcaréis mares diversos, y combatireis contra poderosos elementos, vuestro jóven corazon se verá agitado por opuestas emociones: hoy los placeres de la novedad; mañana la fatiga moral que la disciplina exige: un dia el terror que inspira la furia de los elementos, otro el entusiasmo por el triunfo de la ciencia sobre su fuerza; y otro, en fin, el desaliento, y el tédio quizas al ver vuestra actividad encerrada en el casco de un buque. Vuestros instructores, previendo esos naturales contrastes, desean animaros con algunas reflexiones. Fijad en vuestro espíritu lo noble de vuestra mision, y la estension de conocimientos que la profesion abraza; y esta doble idea os dará aliento para resistir la fatiga, y disipar el tedio. La defensa del débil, del comercio, de vuestras envidiadas instituciones políticas, y de la dignidad nacional, son objetos bien dignos de esfuerzo para un oficial de elevados sentimientos. El estudio de las leyes que gobiernan las corrientes oceánicas, y fijan la marcha de los huracanes; el de la influencia que en ellos ejercen varios agentes químicos, y los cuerpos celestes; el modo de fijar los escollos que puedan presentarse en los mares y rios; el estudio de las ramificaciones de estos entre si para establecer por ellas nuevas vias de communicacion, ó acortar las ya conocidas en beneficio del comercio y de la humanidad; estos y otros objetos que forman el estudio del marino del siglo 19, ofrecen un ancho campo á vuestra actividad intelectual. "¿Creeis que los trastornos atmosféricos (escribe elocuentemente un oficial de la marina española) son para el marino contrariedades del momento, y que su cuidado debe limitarse á escapar del peligro diciendo: "ya esto pasó, hasta otro que venga cuando, y como le plazca? No, él debe interrogar á los huracanes, pedirles razon y cuenta de cuantos fenómenos envuelve, y este interrogatorio archivado con otros de igual naturaleza, debe servirle para compararlos, y deducir exactas tesis meteorolójicas." Si, queridos amigos, vuestra profesion protectora y científica á la vez, es no solo necesaria en tiempo de guerra, sino progresiva y benéfica en tiempo de paz. Concentrad vuestra atencion en algunas de sus ramas (la que mas os guste): conviene que el hombre tenga *un fin* de su agrado, porque todas las ciencias estan entrelazadas, y de este modo estudia sin tédio todo lo que contribuye á ese fin. En cuanto á los lenguajes, leed los periódicos, id al teatro, y tratad de hablar en todas ocasiones. Los lenguajes dan una idea muy favorable de quien los posee, y en tiempos de peligro veréis la verdad de la proposicion que dice: "el hombre que conoce dos lenguajes vale por dos hombres." Pero acabemos ya, porque necesitais descanso, y vuestra conducta durante el año os hace bien merecedores de él. Vuestros instructores se asocian al placer que vais á sentir y dar, mañana, á vuestras familias, y amigos; y al deciros a Dios! os desean salud y buen suceso en la carrera que se abre ante vosotros.

El Gefe del Departamento, y los instructores en el ramo de Español.

CADET-ENGINEERS.

FIRST CLASS.

DEPARTMENT OF STEAM-ENGINEERING.

MARINE ENGINES.

ANNUAL EXAMINATION.

JUNE, 1878.—*Time allowed, five hours.*

1. If, in a binary vapor-engine, the steam exhausts at a pressure of 10 pounds per square inch per gauge through the tubes of a receiver containing bisulphide of carbon, what is the maximum pressure that can be obtained in the receiver?

Barometer, 30″.

	A	Log B	Log C	$\frac{B}{2c}$	$\frac{B^2}{4c^2}$
For water	8.2591	3.43642	5.59873	0.003441	0.00001184
For bis. carb.	7.3438	3.30728	5.21839	0.006136	0.00003765

2. Compute the efficiencies of a square foot of the crown-sheet of a furnace, when the fuel (considered pure carbon) is burned with 18 and 24 pounds of air, the water being evaporated at a temperature of 250° Fah.

3. Given boilers of 200 square feet grate surface, burning 15 pounds coal (C, 0.915, H, 0.035, O, 0.026) per square foot per hour. Required the number of cubic feet of air necessary. Deduce the formula (weight of one cubic foot of air 0.0807).

4. The efficiency of the boilers in the last question being 55 per centum, for how many horse power would they furnish steam at 35 pounds per gauge, supposing each H. P. to require 285 pounds of steam per hour, temperature of feed-water 110° Fah.

5. The boilers of question 3 have horizontal fire-tubes discharging into a common back connection at base of smoke-pipe. There are 744 tubes 10′ 6″ long and $2\frac{1}{4}$″ internal diameter. There is supplied 300 cubic feet of air at 60° Fah. per pound of fuel. Compute the height of the smoke-pipe.

6. Sketch and describe an Ericsson's air-engine and draw the theoretical diagram. Explain why the efficiency differs from that of the steam-engine. Why is it not adapted to marine purposes?

7. Supposing the cylinder to be non-conducting, what is the H. P. from the following data, viz: Internal pressure per gauge 30 pounds; vacuum, per gauge 26 inches; barometer 30 inches; cut-off $\frac{3}{8}$; diameter of cylinders 36″; number of cylinders 2; length of stroke 3′; revolutions per minute 65. (Take the weight of one cubic inch of mercury .5 pound.)

8. Define isothermal and adiabatic lines and show under what circumstances they occur in diagrams of energy. Prove that the mechanical equivalent of heat absorbed or given out by a body in passing from a given state as to pressure and volume to another state as to pressure and volume, through a series of states represented by the co-ordinates of a curve on a diagram of energy, is represented by the area included between the given curve and two curves of no transmission drawn from its extremities and indefinitely prolonged.

9. Why is high-pressure steam more economical than low-pressure steam? What is a steam-jacket? State the relative advantages of jacketing the different cylinders of a compound engine. Define superheated steam. How many degrees of superheating produces steam gas?

10. State the second law of thermodynamics: deduce the general expression for the thermodynamic function of a substance.

DESIGNING MACHINERY.

ANNUAL EXAMINATION.

JUNE, 1878.—*Time allowed, five hours.*

1. Give I. H. P. from following data: Length of vessel on water-line, 250 feet: mean immersed girth, 35 feet: mean of squares of sines of greatest obliquity, .025; mean of fourth powers of sines, .0008; coefficient of propulsion, 20,000; speed, 15 knots of 6086 feet.

2. Give the diameter of cylinder from the following data: Two equal cylinders, non-compound; indicated horse-power, 1,700; pressure, per gauge, 40 pounds: revolutions per minute, 60; stroke of piston, 4 feet; clearance, 8½ per cent. of stroke-displacement of piston; cut-off, 28″.5 from beginning: vacuum, 26 inches: barometer, 30 inches. Neglect compression.

3. Give diameter of crank-shaft, of iron, for a pair of engines, from the following data; resistance to torsion only to be provided for: Diameter of piston, 60 inches; stroke, 48 inches; pressure, per gauge, 40 pounds; factor of safety, 8. State the practice approved by the Bureau of Steam-Engineering in regard to length of shaft-journals.

4. Give the diameter of after crank-pin from the data of question 2; length, 20 inches; material, wrought iron: factor of safety, 8.

5. Give diameter of neck of connecting-rod from the data of question 3; length, 80 inches; material, wrought iron; factor of safety, 8.

6. Give steam-lap and lead, exhaust-lap and lead, and travel of valve, from the following data: $S = 48$ inches; width of steam-port, 4 inches: cut-off, 36 inches from beginning: steam-valve opens when piston is ½ inch from end of stroke; exhaust-valve closes when piston is 38 inches from beginning of stroke. Scale of crank-circle, $1\frac{1}{2}'' = 1$ foot.

7. Design a Meyer expansion-valve in conformity to the following data: $S = 36$ inches; width of steam-port, 3 inches; steam-lap, 1¼ inches; main valve to close when piston is 32 inches from beginning of stroke; cut-off variable from ⅓ stroke to point of cut-off of main valve, due to its lap; greatest distance between centres of cut-off valve and main valve, 4 inches (Ex. $= 4''$); blocks to be in contact when following farthest ($x = 0$). Find, first, travel of cut-off valve in inches; second, minimum length of blocks; third, width of main valve between outer edges of ports; fourth, point of cutting-off with blocks 3 inches apart. Scale of crank-circle, $1\frac{1}{2}'' = 1$ foot. All valve-circles full size.

8. Give pounds of coal consumed per hour in supply of a pair of engines of 1,700 I. H. P., requiring 26 pounds of steam per I. H. P. Pressure, per gauge, 40 lbs. Temperature of feed-water 110° Fah. Give also square feet of grate surface, of heating surface, and of calorimeter, the boilers being of the vertical water-tube kind.

9. Give square feet of condensing surface and diameter of circulating pump, using data of questions 2 and 7. Pump, double-acting; stroke, 48″: temperature of injection, 70° Fah.; of discharge, 80° Fah.

10. Give area of feathering-paddles required by vessel in question 1: slip 25 per cent. of given speed; to work in still water.

SECOND CLASS.

DESIGNING OF MACHINERY.

ANNUAL EXAMINATION.

JUNE, 1878.—*Time allowed, five hours.*

1. Prove that the angular velocities of two arms are inversely as the perpendiculars from their centres of motion upon the link.

2. Two shafts meet, making an angle of 80°; the angular velocity-ratio of the driver and follower is $\frac{2}{3}$; required, the angles of the pitch cones for bevel gear.

3. Define pitch circle. Given, a wheel of 31.82 inches diameter and 100 teeth, required, the pitch.

4. Two wheels, with constant directional relation, driver to revolve uniformly, follower to revolve twice to the driver's once, and to remain at rest half the time. Sketch device by which this can be accomplished, and give the ratio of the radii of the two wheels.

5. Apply the second solution to the formation of the teeth of wheels.

6. Prove that involute teeth preserve a constant velocity-ratio when the distance between the axes is varied.

7. Lay down a cam that will give a bar whose line of direction passes through the axis of the cam a uniform reciprocating motion.

8. Two shafts at right angles lie in horizontal planes 15 feet apart; upon the upper or driving shaft is a pulley 30 inches in diameter, which is to be connected with a pulley on the lower shaft by an endless belt, so that the angular velocity-ratio shall be $\frac{2}{3}$. Required, the diameter of the lower pulley and the positions upon the shafts of both.

9. Determine the motion of a slide when the path of the end of the link travels in a line tangent to the circle described by the extremity of the crank-arm.

10. Construct geometrically a quick-return motion, such that the period of return shall be one-third the period of advance.

11. Give, the train for a thirty-two day clock fitted with a seconds' pendulum, and to carry but 16 coils on the winding barrel.

12. Define an epicyclic train. Find the velocity-ratios of epicyclic trains.

13. The counter-shaft of a lathe makes 86.4 revolutions per minute, the cones have 4 pulleys each, and the lathe has back-gear. The changes are to be by geometric progression from 4 revolutions per minute upward. Deduce the sizes of the pulleys and the train for the gears, the common ratio being 1.75, and the sum of the diameters 20 inches.

14. Sketch a differential pulley. State the condition of equilibrium.

15. Design a feed motion for a drill-press, such that the feed shall be uniform and $\frac{1}{50}$ of an inch per revolution.

DEPARTMENT OF MECHANICS AND APPLIED MATHEMATICS.

STRENGTH OF MATERIALS.

SEMI-ANNUAL EXAMINATION.

January, 1878.—*Time allowed, five hours.*

1. Show that the sum of the moments of inertia of a surface relatively to a pair of rectangular neutral axes is isotropic.

A closed hemispherical vessel filled with liquid is held with a point in its edge uppermost; find its position when the sum of the pressures on the concave and plane surfaces is the greatest possible.

2. Show that if the stresses on a given pair of planes be tangential to those planes and parallel to a third plane which is perpendicular to the pair of planes, the stresses must be of equal intensity.

If a hemispherical vessel whose weight is W, floats upon a fluid with one-third of its axis below the surface, find the weight which must be put into the vessel in order that it may float with two-thirds of its axis below the surface.

3. Define *elasticity, stress, strain, toughness, stiffness*, and *resilience*.

Determine the ratio of the radii in the case of a thick hollow cylinder subjected to given external and internal pressures.

4. Derive the formula for moment of flexure of beams, $M = \frac{p}{y} I$.

Find the greatest deflection of a beam of uniform strength and breadth uniformly loaded and supported at both ends.

5. A beam of uniform strength and depth is fixed at both ends and uniformly loaded: find the maximum deflection, maximum moment of flexure, and points of contrary flexure.

6. Find the limiting length of a rectangular oak beam, in which $\frac{l}{h} = 20$, and whose weight per cubic foot is 51.84 lbs., the resistance to breaking across being 10,000 lbs. per square inch, and the factor of safety 5.

Show that for equal values of the limiting stress f, the resistance of a cylinder, solid or hollow, to wrenching, is double its resistance to breaking across.

7. Derive the formula for the proper thickness of the teeth of toothed wheels.

In the case of pillars and struts, find the ratio of the stress due to direct pressure to the additional stress due to bending.

8. Define the terms *jet, current, vortex*, and *steady motion*.

State the general principles of continuity and derive the general differential equation of continuity.

9. Show that in steady motion the sum of the height due to the velocity of a particle and of its dynamic head is constant.

The times of emptying a segment of a sphere through equal small orifices in its vertex and base are as 2 to 3, the base being horizontal in both cases; compare the volume of the segment with that of the sphere.

10. Define *free, forced*, and *combined vortices*, and show that in a free circular vortex, the velocity is inversely as the distance from the axis.

Find the pressure of a jet against a fixed surface.

METHOD OF LEAST SQUARES.

ANNUAL EXAMINATION.

JUNE, 1878.—*Time allowed, five hours.*

1. Classify and define the errors likely to occur in ordinary observations. What principles form the basis of the law of the probability of error?

2. A number of coins is tossed up; derive the general expression for finding the probability of any particular combination. A person tosses up two coins together four times; what is the probability that two heads will be thrown once at least?

3. Derive the equation of the probability curve $y = ce^{-h^2x^2}$, and determine the constant c.

4. Explain why the term *least squares* is used; define *measure of precision, probable error*, and *weight*, and distinguish between the terms *error* and *residual*. A line is measured five times, and the probable error of the mean is found to be 0.016 ft.; how many additional measurements of the same precision are necessary in order that the probable error of the mean shall be only 0.004 ft.?

5. Derive the formula for determining the probable error of an observation of weight unity in the case of direct observations of unequal precision upon a single quantity, and thence deduce the formula for the probable error of the general mean.

6. A certain line was measured by three different surveying parties, and the following results were obtained: 1*st party*, 5110, 5090, 5140, 5100, 5120; 2*nd party*, 4980, 5100, 5220, 5160, 5040, 5100; 3*rd party*, 5105, 5100, 5110, 5105. Determine the relative weights of the three means and the most probable length of the line.

7. In the case of independent observations, of unequal weight, upon several quantities, derive the requisite formulas, and develop the method of finding the most probable values of the quantities and of determining the probable errors of the results.

8. A chronometer is rated at a certain date, and is found to be $9^m\,12^s.3$ fast, with a probable error of $0^s.3$; ten days afterward it is again rated and is found to be $9^m\,21^s.4$ fast, with the same probable error; determine the probable error of the mean daily rate. Having given the observation equations, $2x+y=7$, with weight 5; $x+3y=6$, with weight 1; $x-y=2$, with weight 4; find the values and the weights of x and y.

9. In the case of conditioned observations of unequal weight upon several quantities, develop the method of finding the most probable values of the quantities and the probable errors of these values.

10. At the point O, four angles are measured:—$AOB=w=40°\,52'\,37''$, with weight 16; $BOC=x=92°\,25'\,4''$, with weight 4; $COD=y=80°\,03'\,15''$, with weight 3; $DOA=z=146°\,35'\,20''$, with weight 1; required the most probable values of the angles w, x, y, *and* z.

INDEX

O